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Kentucky Geological Survey.

Bulletin No. 3.

CHEMICAL REPORT
OF THE
COALS, CLAYS, MINERAL WATERS, ETC.
OF KENTUCKY.

1905.

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Kentucky Geological Survey

CHARLES J. NORWOOD, Director.

BULLETIN NO. 3.

CHEMICAL REPORT

OF THE

Coals, Clays, Mineral Waters, Etc.

OF KENTUCKY.

BY

ROBERT PETER, M. D.

LATE CHEMIST TO THE SURVEY.

Being the Ninth Chemical Report in the Second Series and the Thirteenth
Since the Beginning of the Survey.

COMPILED FROM THE LABORATORY NOTE BOOKS BY
ALFRED M. PETER.

Office of the Survey: Lexington, Ky.



1905.

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INDEX.

	Page.
Adair county, analyses of mineral waters from,.....	7
Adelida Springs, Graves county, analyses of water from,.....	39
Allen Spring, warren county, analysis of the water of,.....	70
Analyses reported, classification of,.....	6
Anderson county, analysis of mineral water from,.....	7
"Asphalt rock," Breckinridge county,.....	26
Barren county, analysis of mineral waters from,.....	8
Bell county, analyses of coals and cokes from, pp. 9-19; fire-clay, 20; iron ore, 22; limestones, 21.	
Bethesda Spring, Hardin county, analysis of the water of,.....	42
Bituminous sandstone, Breckenridge county,.....	26
Boyd county, analyses of clays from, pp. 23, 24; coal, 20.	
Breathitt county, analyses of coals from,.....	24, 25
Breckenridge county, analyses of clays from, p. 21; bituminous sand- stone, 25.	
Bryson's Mountain coal, analysis of,.....	76
Caldwell county, analysis of clay and iron ore from,.....	26
Cannel coals, analyses of, Breathitt county, 24, 25; Clay county, 30, 31.	
Carter county, analyses of clays from, pp. 27, 28; coals, 29; fire brick, 28; iron ore, 29, 30.	
Clark county galena,.....	30
Clay county coals and mineral water, analyses of,.....	30, 31
Clays, analyses of, Bell county, p. 20; Boyd, 23, 24; Breckenridge, 25; Caldwell, 26, 27; Carter, 27, 28; Crittenden, 33; Daviess, 34; Estill, 35; Fayette, 36; Graves, 39; Hancock, 41; Henry, 43; Jefferson, 46; Lawrence, 49; Leslie, 50, 51; Livingston, 52; Meade, 57; Mc- Cracken, 60, 61; Rockcastle, 68, 69.	
Coals, analyses of, Bell county, pp. 10-19; Boyd, 22; Breathitt, 24, 25; Carter, 29; Clay, 30, 31; Daviess, 34; Floyd, 36-38; Greenup, 40; Hopkins, 44; Johnson, 47; Knox, 47, 48; Lawrence, 49, 50; Leslie, 51, 52; Magoffin, 53; Martin, 54, 55; Morgan, 58-60; Ohio, 62, 63; Pike, 64-67; Wayne, 72, 73; Whitley, 73; State of Tennessee, 74-76.	
Cokes, analyses of, Bell county, pp. 9, 10; State of Tennessee, 77.	
Crittenden county, analyses of clays and marls from,.....	31-33
Analyses of lead and zinc ore from,.....	33
Daviess county, analysis of clay from,.....	34
Analysis of mineral waters from,.....	34, 35
Dawson Springs, Hopkins county, analyses of the waters of,.....	45
Dean Field Coal, analysis of,.....	62, 63
Elkhorn coal, analyses of,.....	65-67
Epperson coal	10
Estill county, analysis of clay from,.....	35
Fayette county,, analyses of brick clay from,.....	36
Fire brick from Carter county clay, analysis of,.....	28
Floyd county, analyses of coals from,.....	36-38
Franklin county, analysis of iron ore from,.....	38
Fulton county, analysis of mineral water from,.....	38
Galena from Clark county, 30; Trigg county, 69.	
Glen Mary coke, analysis of,.....	77
Graves county, analysis of mineral water from, 39; clay, 39, 40.	
Greenup county, analyses of cannal coals from,.....	40
Hancock county, analyses of clays from,.....	41
Hardin county, analyses of mineral waters from,.....	41-43

	Page.
Harmony Springs, Adair county, analyses of the waters of,.....	7
Henry county, analysis of clay from,.....	43
Hickman county, analysis of mineral water from,.....	44
Hignite coal, 11-15; coke from, 9, 10.	
Hood creek clay, analysis of,.....	23, 24
Hopkins county, analysis of coal from, 44; mineral waters, 45.	
Introductory	5
Iron ores, analyses of, Bell county, p. 22; Caldwell, 26; Carter, 29; Franklin, 37; Lawrence, 49; Rowan, 69.	
Jefferson county, analyses of clays from,.....	46
Jellico coal, Whitley county, analysis of,.....	73
Jessamine county zinc ore.....	46
Johnson county, analysis of coal from,.....	47
Keyes creek coal, analysis of,.....	22
Knox county, analysis of coal from,.....	47
Larue county, water from,.....	48
Larue mine, Crittenden county, lead ore from,.....	34
Laurel county, analysis of water from,.....	48
Lawrence county, analyses of clay, coals and iron ore from,.....	49
Lead and zinc ore, Crittenden county,.....	33, 34
Leslie county, analysis of clay from, 50, 51; coals, 51, 52.	
Limestones, analyses of, Bell county, p. 21; Meade, 56; Rockcastle, 67, 68	
Livingston county, analysis of clay from,.....	52
McCracken county, analysis of clay from,.....	60, 61
Magoffin county, analyses of coals from,.....	53
Marion county, analysis of mineral water from,.....	54
Marls, analyses of, Crittenden county, 31, 32; Meade, 55, 56.	
Martin county, analyses of coals from,.....	54, 55
Meade county, analyses of clay from, 57; limestones, 56; shale, 55, 56; soils, 56, 57.	
Mercer county, analysis of mineral water from,.....	58
Mineral waters, analyses of, Adair county, p. 7; Anderson, 7; Barren, 8; Daviess, 34; Fulton, 38; Graves, 39; Hardin, 41-43; Hickman, 44; Hopkins, 45; Larue, 48; Laurel, 48, 49; Marion, 54; Mercer, 58; Nelson, 61; Nicholas, 62; Ohio, 63; Warren, 70; Wayne, 72; Woodford, 74.	
Nelson county, analysis of mineral water from,.....	61
Nicholas county, analysis of mineral water from,.....	62
Ohio county, analyses of coals and mineral water from.....	62, 63
Parks Hill mineral water, analysis of,.....	62
Peach Orchard coal, Lawrence county, analysis of,.....	49, 50
Pike county, analyses of coals from,.....	64-67
Poplar Lick coal.....	12-16
Red Spring coal, coke from,.....	9
Rockcastle county, analyses of clays from, 68, 69; limestones, 67, 68.	
Rowan county, analysis of iron ore from,.....	69
Salt water, analyses of, Barren county, 8; Hardin, 43.	
Soils, analyses of, Meade county, pp. 56, 57; Warren, 71.	
South Park mineral well, Owensboro, analysis of water from,.....	35
Sylvan Spring, Hardin county, analysis of the water of,.....	42
Tabb mine, Crittenden county, zinc ore from,.....	33
Tennessee, analyses of coals and cokes from,.....	74-77
Trigg county, analysis of galena from,.....	69
Warren county, analyses of soils and mineral waters from,.....	70, 71
Wayne county, analyses of coal and mineral water from,.....	72, 73
Whitley county, analysis of coal from,.....	73
Woodford county, analysis of mineral water from,.....	74
Zinc ore, Crittenden county, 33; Jessamine, 46.	

LETTER OF TRANSMITTAL.

*To His Excellency, J. C. W. BECKHAM,
Governor of Kentucky.*

Sir: I have the honor to transmit for publication the accompanying report of chemical analyses made by Dr. Robert Peter, who was for so many years the honored and distinguished Chemist of the Kentucky Geological Survey. The analyses were, at my request, compiled from the laboratory books by Prof. Alfred M. Peter, present Chemist to the Survey.

Very respectfully,

CHARLES J. NORWOOD,
State Geologist.

Lexington, Ky.

LETTER OF SUBMITTAL.

LEXINGTON, KY., May 1, 1905.

PROF. CHARLES J. NORWOOD,

Director of the Geological Survey of Kentucky, etc.

SIR: I have the honor to submit to you herewith a report of the chemical analyses made by Dr. Robert Peter, late Chemist to the Survey, from January 22, 1890, up to the discontinuance of the survey under Mr. Procter, and still remaining unpublished, compiled by me from the laboratory note-books, and including a few more recent analyses found recorded in the same books.

Very respectfully,

ALFRED M. PETER.

INTRODUCTORY.

When the Geological Survey of Kentucky under Director John R. Procter was discontinued, in 1892, on account of the failure of the Legislature to make the necessary appropriations, Dr. Robert Peter, then Chemist of the Survey, submitted to Director Procter, for publication, a manuscript report of the chemical work completed up to that time, not included in the previous report, covering a period from January 22, 1890, to May 1, 1892.

Through lack of funds this report was not published, and the manuscript seems to have been misplaced or lost, all efforts of the present Director to find it having proved unsuccessful. As both Director Procter and Dr. Robert Peter have passed away, and as the belongings of the Survey have gone through the hands of several custodians in the last twelve years, further search for the lost manuscript seemed hopeless, and, accordingly, Director Norwood requested the present writer to make a compilation of the analyses included in that report, for publication.

The following pages comprise such a compilation, and are a faithful and almost literal copy of the analyses as found recorded in the original laboratory note-book, with such remarks or comments as are there found, and without any attempt at discussion or comment by the present writer. It has been thought proper to include also a few more recent analyses found in the note-books, distinguishable by their dates, some of them made by the present writer. There are here reported 236 analyses of coals, clays, waters, and other materials, including analyses of fourteen coals and two cokes from Tennessee, adjacent to our southeastern coal field. These analyses may be classified as follows:

- 1 Bituminous sandstone—Breckenridge county.
- 43 Clays—Bell county, 5; Boyd, 7; Breckenridge, 2; Caldwell, 1; Carter, 5; Crittenden, 6; Daviess, 1; Estill, 1; Fayette, 1; Graves, 1; Hancock, 2; Henry, 1; Jefferson, 2; Lawrence, 1; Leslie, 1; Livingston, 1; Meade, 2; McCracken, 1; Rockcastle, 2.
- 126 Coals—Bell county, 39; Boyd, 1; Breathitt, 3; Carter, 2; Clay, 3; Floyd, 8; Greenup, 2; Hopkins, 1; Johnson, 1; Knox, 1; Lawrence, 4; Leslie, 6; Magoffin, 5; Martin, 7; Morgan, 9; Ohio, 3; Pike, 15; Wayne, 1; Whitley, 1; Tennessee, 14.
- 10 Cokes—Bell county, 8; Tennessee, 2.
- 1 Fire-brick—Carter county.
- 6 Iron ores—Bell county, 1; Caldwell, 1; Carter, 1; Franklin, 1; Lawrence, 1; Rowan, 1.
- 5 Lead and zinc ores—Clark county, 1; Crittenden, 2; Jessamine, 1; Trigg, 1.
- 7 Limestones—Bell county, 3; Meade, 2; Rockcastle, 2.
- 4 Soils—Meade county, 2; Warren, 2.
- 33 Mineral waters—Adair county, 2; Anderson, 1; Barren, 2; Clay, 1; Daviess, 2; Fulton, 1; Graves, 2; Hardin, 4; Hickman, 1; Hopkins, 3; Larue, 1; Laurel, 1; Marion, 1; Mercer, 1; Nelson, 1; Nicholas, 1; Ohio, 2; Wayne, 1; Warren, 4; Woodford, 1.

In the following pages these analyses are arranged by counties, as usual, the names of the counties being given in alphabetical order.—A. M. P.

ANALYSES ARRANGED BY COUNTIES.

ADAIR COUNTY MINERAL WATERS.

No. 3041—Mineral water from Harmony Springs (No. 1), eight miles south of Columbia, Adair county, Ky. Sample sent by Mr. H. C. Baker, of Columbia. Slight ferruginous sediment in the bottle.

No. 3042—From Harmony Springs (No. 2); same locality as the next preceding. Sent by Mr. H. C. Baker, who says the springs are located near each other. No sediment in the bottle.

COMPOSITION IN 1000 PARTS.

Number	3041	3042
Iron carbonate.....	0.013	Trace
Lime carbonate.....	0.065	N. E.
Magnesia carbonate	0.004	N. E.
Lime sulphate.....	0.036	N. E.
Magnesia sulphate	0.027	N. E.
Sodium chloride	Trace	Trace
Total saline matters.....	0.145	0.145

No. 3041 is a weak saline chalybeate water. No. 3042 differs only slightly from the preceding, containing no notable amount of carbonate of iron. They scarcely deserve the name of "mineral waters."

ANDERSON COUNTY MINERAL WATER.

No. 3043—Mineral water from spring in the vicinity of Lawrenceburg, Anderson county, Ky., on James McBrayer's place. Sample brought by Mr. K. R. Forston.

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COMPOSITION IN 1000 PARTS.

Iron carbonate.....	0.007
Lime carbonate.....	0.200
Magnesia sulphate.....	0.081
Sodium chloride.....	0.050
Potassium chloride.....	Trace
Silica	0.032
Total saline matters.....	0.370

BARREN COUNTY MINERAL WATERS.

No. 3044—Mineral water, sent by S. E. Jones, Glasgow, Ky., from the Jones well, July 10, 1890. The water was discovered when boring for oil, seventy feet below the surface. There was a white sediment in the bottle.

COMPOSITION IN 1000 PARTS.

Hydrogen sulphide gas.....	0.059	
Lime carbonate	0.280	} Held in solution by carbonic acid.
Magnesia carbonate.....	0.163	
Sodium chloride	3.080	
Potassium chloride....	0.369	
Lime sulphate	0.766	
Magnesia sulphate	0.086	
Aluminum, a trace.....	N. E.	
Silica	0.016	
Total saline matters.....	4.760	

A saline sulphur water. The whitish sediment is mostly sulphate of lime. Contains more hydrogen sulphide at the well.

No. 3045—Mineral water, from Glasgow, Barren county, Ky.; sent by W. Gordon; from a drilled well, 350 feet below the surface; a salt water. At 500 feet got a strong flow of sweet water. These two waters are possibly mixed in the sample.

COMPOSITION IN 1000 PARTS OF THE WATER.

Hydrogen sulphide.....	N. E.	
Lime carbonate	0.74	} Held in solution by carbonic acid.
Magnesia carbonate.....	1.32	
Sodium chloride	44.00	
Lime sulphate.....	6.00	
Silica	0.07	
Total saline matters.....	52.13	

BELL COUNTY COALS AND COKES.

No. 3046—Coke, labeled “5 ft. coal; upper 14 inches 72-hour coke, Straight Creek, Bell county, Ky.” Sample brought by A. R. Crandall, April 4, 1890.

No. 3047—Coke, labeled “Straight Creek, Bell county (5 ft. coal) coke of the lower 35 inches 56-hour coke.” Brought by A. R. Crandall, April 4, 1890.

No. 3048—Coke, labeled “Forks of Straight creek, Bell county, Ky., 5-foot coal; whole thickness 54-hour coke.” On land of Pineville Iron and Coal Co. Brought by A. R. Crandall.

No. 3049—Coke, labeled “No. 1. Clear creek, a tributary of Big Clear creek, nearly 13 miles from Pineville, Bell county, Ky. Coke made at Pineville from Poplar Lick bed; coked 48 hours. Sample by G. M. Sullivan.”

No. 3050—Coke labeled “No. 5. Head of Bear creek, a tributary of Big Clear creek, 13 miles from Pineville, Bell county, Ky., made of Red Spring coal; 48-hour coke made at Pineville. Sample by G. M. Sullivan, Oct. 2, 1890.”

No. 3051—Coke, labeled “No. 2. Bear creek, a tributary of Big Clear creek, 13 miles from Pineville, Bell county. Coke made from lower bench of Hignite coal; 48-hour coke made at Pineville. Sample by G. M. Sullivan, Oct. 2, 1890.”

No. 3052—Coke, labeled “No. 4. Sugar Camp branch of Bear creek, a tributary of Big Clear creek, 13 miles from Pineville, Bell county; made from lower bench of Hignite coal; 48-

hour coke made at Pineville. Sample by G. M. Sullivan, Oct. 2, 1890."

No. 3053—Coke, labeled "No. 3. Bear creek, a tributary of Big Clear creek, 13 miles from Pineville, Bell county, Ky.; 48-hour coke made at Pineville from upper bench of Hignite coal. Sample by G. M. Sullivan, Oct. 2, 1890."

COMPOSITION OF THESE BELL COUNTY COKES, AIR-DRIED.

Number	3046	3047	3048	3049	3050	3051	3052	3053
Hygroscopic moisture	0.90	1.00	0.90	3.00	1.00	2.10	2.00	0.60
Volatile combustible matters	.10	.30	.10	1.00	.34	.42	.38	.20
Coke	99.00	98.70	99.00	96.00	98.66	97.48	97.62	99.20
Totals	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00
Total volatile matters	1.00	1.30	1.00	4.00	1.34	2.52	2.38	.80
Fixed carbon in the coke	92.20	91.80	91.80	88.26	90.26	89.94	90.76	87.58
Ash	6.80	6.90	7.20	7.74	8.40	7.54	6.86	11.62
Totals	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00
Percentage of sulphur	2.905	1.986	2.17	0.673	0.412	.659	.521	.909
Character of the coke . . . . .	.....	.....	.....	.....	.....	.....	.....	.....
Color of the ash	Red	Red	Red	Brownish grey	Brownish red	Dark reddish brown	Brownish grey	Dark grey

No. 3054—Coal, labeled "Symmes Fork of Left Fork of Straight creek, about 2 miles above T. W. Culton's, Bell county. Sample from outcrop, face 35 inches; soft coal with no pyrites showing. Collected by G. M. Sullivan, May 28, 1890. Known as the Epperson Coal."

No. 3055—Coal, labeled "Caney Fork of Left Fork of Straight creek, near to B. A. Rice's house, Bell county; lower coal measures. Sample from the whole face, 38 inches; no parting; no pyrites showing. Collected by G. M. Sullivan, June 2, 1890."

No. 3056—Coal, labeled "Right Fork of Straight creek, 3 miles from Pineville, Bell county. Sample from the 50-inch face, without parting, near the outcrop, by G. M. Sullivan, June 2, 1890."

No. 3057—Coal, labeled "Ransom's branch of Left Fork of Straight creek, near Ransom Slusher's, Bell county; 160-175 feet below fossil limestone of coal measures. Collected by G. M. Sullivan, May 27, 1890. Upper bench, 18 inches; lower bench, 13½ inches; parting, 2 inches bituminous sandstone."

No. 3058—Coal, labeled "Lower bench of Hignite coal, on Sugar Camp branch of Bear branch of Big Clear creek, 15 miles from Pineville, in Bell county. Lower coal measures, 750 feet above drainage. Sample from the whole face, 41-inch and 3½-inch coal, separated by 1½-inch clay. Sample by G. M. Sullivan, July 8, 1890."

No. 3059—Coal, labeled "Red Spring coal, Hignite branch of Yellow creek, Bell county, Ky., 475-500 feet above Hignite coal. Sample from the 39½-inch face. Sample by G. M. Sullivan, 1890."

No. 3060—Coal, labeled "Upper bench Hignite, on Bear branch of Clear creek, Bell county, about 12-15 miles from Pineville. Lower coal measures, 750 feet above drainage. Sample from the whole face, 42 inches, with knife-edge parting 25½ inches from top of the bed. Sample by G. M. Sullivan, July 8, 1890."

No. 3061—Coal, labeled "Upper bench of Hignite, on Sugar creek of Bear branch of Big Clear creek, 15 miles from Pineville, Bell county, Ky. Lower coal measures 750 feet above drainage. Sample from the 29½-inch and 3½-inch benches, separated by 2 inches of bituminous shale. The lower part of the bed, 4 feet, 6 inches, of cannel coal, not sampled. Sample by G. M. Sullivan, July 8, 1890."

No. 3062—Coal, labeled "At head of Bear branch of Big Clear creek, 15 miles above Pineville, Bell county, Ky., 450 feet above Hignite bed. Sample from 30½-inch bed. Sample by G. M. Sullivan."

No. 3063—Coal, labeled "Lower bench of the Hignite, on Bear branch of Big Clear creek, Bell county. Lower coal measures, 750 feet above drainage. Sample from the 46-inch face,

part of which shows birds-eye fracture. Collected by G. M. Sullivan, July 8, 1890."

No. 3064—Coal, labeled "Poplar Lick coal, on Bear branch of Big Clear creek, Bell county, Ky., 12 miles above Pineville. Lower coal measures, 500 feet above drainage. Sample from the whole bed, the 17½-inch and the 32½-inch benches. Sampled by G. M. Sullivan, July 8, 1890."

No. 3065—Coal, labeled "Hignite Fork of Stony Fork of Yellow creek, Bell county. Lower bed of Hignite coal, 44¾ inches thick, with three knife-edge partings of mineral charcoal. Collected by G. M. Sullivan, August 18, 1890."

No. 3066—Coal, labeled "Head of Hignite creek of Stony Fork of Yellow creek, Bell county, Ky. Lower seam of upper bed of Hignite coal, 36 inches thick, with three knife-edge partings of mineral charcoal. Collected by G. M. Sullivan, August 10, 1890."

COMPOSITION OF THESE BELL COUNTY COALS, AIR-DRIED.

Number	3054	3055	3056	3057	3058	3059	3060	3061	3062	3063	3064	3065	3066
Hygroscopic moisture	3.00	2.20	2.00	1.60	2.66	2.20	2.00	1.80	2.60	1.60	1.80	3.00	2.50
Volatile combustible matters	32.80	33.80	34.70	37.80	34.14	34.20	32.80	35.60	33.20	33.40	33.00	30.40	29.70
Coke	64.20	64.00	63.30	60.60	63.20	63.60	65.20	62.60	64.20	65.00	65.20	66.60	67.80
Totals	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00
Total volatile matters	35.80	36.00	36.70	39.40	36.80	36.40	34.80	37.40	35.80	35.00	34.80	33.40	32.20
Fixed carbon in the coke	58.98	62.70	62.02	54.40	59.70	60.40	59.50	58.30	60.20	61.52	60.10	64.00	62.80
Ash	5.22	1.80	1.28	6.20	3.50	3.20	5.70	4.30	4.00	3.48	5.10	2.60	5.00
Totals	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00
Percentage of sulphur	.601	.529	.458	.360	0.840	.576	.986	0.599	0.670	0.794	0.658	.601	.554
Character of the coke	Dense	Dense	Spongy	Spongy	Spongy	Spongy	Spongy	Spongy	Spongy	Light	Light	Light	Spongy
Color of the ash	Light brown-grey	Light reddish brown	Light reddish brown	Nearly white	Grey brown	Light brownish grey	Brownish	Light brownish grey	Light brownish grey	Grey brown	Light grey brown	Grey brown	Light grey brown

No. 3067—Coal, labeled “Hignite creek, about 2 miles from the mouth, Bell county, 275 feet below Hignite coal. Sample from the lower seam of the bed; $20\frac{1}{4}$ inches coal, 3 inches soft clay and 11 inches coal. Sample taken 6 feet from the outcrop. By G. M. Sullivan. Some pyrites apparent. ‘Poplar Lick’ coal.”

No. 3068—Coal, labeled “Moses branch of Little Clear creek, 3 miles from Pineville, Bell county; coal 39 inches with a thin parting 13 inches from the bottom. Collected by G. M. Sullivan, August 6, 1890.”

No. 3069—Coal, labeled “Polk branch, head of Little Clear creek, Bell county. Average sample from the 48-inch bench near the outcrop. Collected by A. R. Crandall, August 6, 1890.”

No. 3070—Coal, labeled “Little Clear creek, Bell county. Average sample from 49-inch bed without parting (running hard). Collected by A. R. Crandall, August 7, 1890.”

No. 3071—Coal, labeled “Head of Caney branch of Clear creek, Bell county. Hignite coal, upper portion. Average sample from the two upper benches, 49 inches coal and $5\frac{1}{2}$ -inch parting. Collected by G. M. Sullivan, August 8, 1890.”

No. 3072—Coal, labeled “Lower seam Hignite, on Little Clear creek, $8\frac{1}{2}$ miles from Pineville, near Wm. J. Carter’s, Bell county. Bed, 42 inches, with thin partings near the bottom, $1\frac{1}{2}$ and 1 inch thick. Collected by G. M. Sullivan, August 8, 1890.”

No. 3073—Coal, labeled “Polk branch of Little Clear creek, 13 miles from Pineville, Bell county. Lower Hignite, 40 inches, no parting. Sample by A. R. Crandall, August 8, 1890.”

No. 3074—Coal, labeled “Caney branch of Big Clear creek, 14 miles from Pineville, Bell county. Lower Hignite seam; $38\frac{1}{2}$ -inch coal, $\frac{1}{2}$ -inch clay parting 2 inches from the bottom. Sampled by A. R. Crandall, August 8, 1890.”

No. 3075—Coal, labeled “‘Poplar Lick’ coal, on Jno. Evans’ place, $12\frac{1}{2}$ miles from Pineville, Bell county, on Little Clear creek. Lower coal measures 50 feet above drainage. Sample from $13\frac{1}{2}$ -inch and 24-inch seams, separated by $2\frac{1}{4}$ -inch clay parting. Collected by G. M. Sullivan, July 19, 1890.”

No. 3076—Coal, labeled “Polk branch of Little Clear creek, Bell county. Bed 6 feet thick, with several partings aggregating 12 inches. Collected by G. M. Sullivan, August 6, 1890.”

No. 3077—Coal, labeled “Poplar Lick coal, near Mark Head’s, 12 miles from Pineville, on Little Clear creek, Bell county. Lower coal measures 150 feet above drainage. Sample from 14-inch and $24\frac{1}{4}$ -inch seams, separated by 2 inches of clay. Collected by G. M. Sullivan, July 19, 1890.”

No. 3078—Coal, labeled “Lower Hignite seam, on Stony Fork of Yellow creek, 8-10 miles above Middlesboro, Bell county. Sample from outcrop of $44\frac{1}{2}$ inches; no parting. Collected by G. M. Sullivan, August 15, 1890.”

No. 3079—Coal, labeled “Laurel branch of Little Clear creek, 10 miles from Pineville, at Jas. Mason’s, Bell county. Lower seam Hignite coal, $38\frac{1}{2}$ -inch and $10\frac{1}{2}$ -inch seams, separated by $11\frac{1}{2}$ inches clay. Sample from the weathered outcrop. By G. M. Sullivan, August 13, 1890.”

COMPOSITION OF THESE BELL COUNTY COALS, AIR-DRIED.

Number	3067	3068	3069	3070	3071	3072	3073	3074	3075	3076	3077	3078	3079
Hygroscopic moisture	2.60	2.30	3.40	3.40	2.50	2.30	2.20	2.40	1.20	2.20	1.60	3.00	4.90
Volatile combustible matters	33.40	34.90	32.40	31.36	32.16	33.90	33.40	33.90	35.60	32.80	34.40	31.96	29.54
Coke	64.00	62.80	64.20	65.24	65.34	63.80	64.40	63.70	63.20	65.00	64.00	65.04	65.56
Totals	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00
Total volatile matters	36.00	37.20	35.80	34.76	34.66	36.20	35.60	36.30	36.80	35.00	36.00	34.96	34.44
Fixed carbon in the coke	59.20	56.40	59.20	58.24	57.54	60.40	61.60	60.50	58.20	54.60	59.40	62.04	62.36
Ash	4.80	6.40	5.00	7.00	7.80	3.40	2.80	3.20	5.00	10.40	4.60	3.00	3.20
Totals	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00
Percentage of sulphur	.549	.766	.563	.601	.556	.629	.601	.632	.408	.408	.682	0.478	.758
Character of the coke	Light spongy	Spongy	Dense spongy	Dense spongy	Light spongy	Light spongy	Light spongy	Spongy	Light spongy	Light spongy	Spongy	Spongy	Fulver- ulent
Color of the ash	Lt. gr. brown	Lt. gr. brown	Brown- ishgrey	Brown- ishgrey	Light brown- ishgrey	Light brown- ishgrey	Light greyish brown	Lt. gr. brown	Light brown- ishgrey	Grey	Grey	Lt. gr. brown	Grey brown

No. 3080—Coal, labeled "Straight creek, Bell county. Average sample from three-room entry. Forks of Straight creek. Average from 5-foot bed. Collected by A. R. Crandall, August 2, 1891."

No. 3081—Coal, labeled "Straight creek, Bell county. Geological position, 200 feet above Pineville coal. Average sample from 49-inch face. Collected by A. R. Crandall, August 2, 1891."

No. 3082—Coal from Bell county, Ky., at head of Big Run branch of right fork of Straight creek, on land formerly owned by Jackson Forrester, in gap between Big Run and right branch of Stony Fork, near top of hill. Sampled by John Wilder, August 11, 1891.

No. 3083—Coal from Bell county, Ky., on Slick Rock branch of Stony Fork of Yellow creek. From $23\frac{3}{4}$ -inch and $9\frac{3}{4}$ -inch seams, separated by $1\frac{1}{2}$ -inch sandstone parting. Sampled by G. M. Sullivan, September 26, 1891.

No. 3084—Coal from Bell county, Ky., on Slick Rock branch of Stony Fork of Yellow creek. Bed $40\frac{1}{2}$ inches, with parting of $\frac{1}{2}$ inch clay 5 inches from top. Sample from badly weathered outcrop. Collected by G. M. Sullivan, September 6, 1891.

No. 3085—Coal from Bell county, Ky., on Stony Fork, $7\frac{1}{2}$ miles from Middlesboro. Sample from 37-inch outcrop, three thin partings of clay—1 inch, 5 inches and $\frac{1}{2}$ inch—being rejected. Collected by G. M. Sullivan, August 26, 1891.

No. 3086—Coal from Bell county, Ky., on Martin's branch of Stony Fork of Yellow creek. Sample from 42-inch face on the outcrop. Lower Hignite coal. Collected by G. M. Sullivan, August 7, 1891.

No. 3087—Coal from Bell county, Ky., on Bean's Fork of Yellow creek. Average from the face, collected by G. M. Sullivan, August 11, 1891. The section is: Coal, 6 inches; shale, 1 inch; coal, 2 inches; clay, 6 inches; coal, 18 inches; shale, 4 inches; coal, 18 inches.

No. 3088—Coal from Bell county, Ky., on Camp branch of Stony creek fork of Yellow creek. Sample from the 42-inch outcrop; no parting. Collected by G. M. Sullivan, August 14, 1891.

No. 3089—Coal from Bell county, Ky., on Martin's branch of Stony Fork of Yellow creek. Sample from the 48-inch face, an outcrop sample, collected by G. M. Sullivan, August 5, 1891. A $\frac{1}{2}$ -inch parting, 26 inches from the top, was excluded.

No. 3090—Coal from Bell county, Ky., on Slick Rock branch of Stony Fork of Yellow creek. Sample from outcrop, collected by G. M. Sullivan, September 26, 1891. The section is: Coal, 6 inches; bone coal, 1 inch; coal, $2\frac{1}{2}$ inches; clay, $1\frac{1}{2}$ inches; coal, 16 inches; clay, $\frac{1}{2}$ inch; coal, 16 inches. The partings were rejected in sampling.

No. 3091—Coal from Bell county, Ky., on Slick Rock branch of Stony Fork of Yellow creek. Sample from 43-inch seam, collected by G. M. Sullivan, September 26, 1891. The section is: Coal, 4 inches; slate, 1 inch; coal, 3 inches; clay, 1 inch; coal, 15 inches; slate, $\frac{1}{4}$ inch; coal 18 inches.

No. 3092—Coal from Bell county, Ky. A small sample sent from Danbury, Conn., by F. A. Hull—a bright, pure-looking coal.

COMPOSITION OF THESE BELL COUNTY COALS, AIR-DRIED.

Number	3080	3081	3082	3083	3084	3085	3086	3087	3088	3089	3090	3091	3092
Hygroscopic moisture	2.00	2.80	4.00	2.60	1.40	2.20	2.20	2.08	3.00	1.40	1.20	2.00	1.40
Volatile combustible matters	33.94	35.70	33.20	32.20	32.86	35.40	35.00	32.92	31.62	32.80	34.00	33.50	39.90
Coke	64.06	61.50	62.80	65.20	65.74	62.40	62.80	65.00	65.38	65.80	64.80	64.50	58.70
Totals	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00
Total volatile matters	35.94	38.50	37.20	34.80	34.26	37.60	37.20	35.00	34.62	34.20	35.20	35.50	41.30
Fixed carbon in the coke	61.06	56.30	58.40	57.30	58.14	59.46	60.20	59.94	62.18	53.80	56.60	55.30	50.70
Ash	3.00	5.20	4.40	7.90	7.60	2.94	2.60	5.06	3.20	12.00	8.20	9.20	8.00
Totals	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00
Percentage of sulphur	.549	1.050	2.046	.548	.549	1.340	.637	.906	.548	.990	2.471	2.288	4.12
Character of the coke	Spongy	Spongy	Dense	Spongy	Dense	Spongy	Light spongy	Light spongy	Dense	Light spongy	Light spongy	Dense	Light spongy
Color of the ash	Lt. grey	Grey	Lt. yellowish grey	Very lt. grey	Light brown	Reddish grey	Reddish grey	Light brownish grey	Lt. reddish grey	Lt. gr.	Lt. gr.	Lt. gr. brown	Purplish grey

BELL COUNTY FIRE-CLAYS.

The following samples of fire-clay were sent for analysis by The Pine Mountain Iron and Coal Co., Pineville, Ky., April 5, 1890. The exact localities were not given, but they are said to be under clays of the lower Pineville coking coal and of the coal 200 feet above that bed. They are indurated clays, becoming plastic with water only when pulverized.

No. 3093—Sample No. 1. A dark gray or dull black indurated clay. It is nearly infusible in the blowpipe flame and burns hard and nearly white.

No. 3094—Sample No. 2. Rather lighter colored than the next preceding. Quite refractory in the blowpipe flame, burning light gray and hard.

No. 3095—Sample No. 3. Gray clay. Fuses slightly on the edges in the blowpipe flame, burning dark gray and hard.

No. 3096—Sample No. 4. Dark gray clay. Infusible in the blowpipe flame, burning hard and gray.

COMPOSITION OF THESE BELL COUNTY CLAYS, AIR-DRIED.

Number	3093	3094	3095	3096
Silica	65.90	60.60	56.20	65.00
Alumina and peroxide of iron.....	24.40	29.60	28.54	23.80
Lime	1.02	0.92	2.50	1.76
Magnesia	Trace	Trace	1.08	0.28
Potash	1.85	1.31	2.51	2.51
Water and undetermined.....	6.83	7.57	9.17	6.65
Total	100.00	100.00	100.00	100.00

No. 3096 $\frac{1}{2}$ —Black clay on Four-mile creek, Bell county, Ky. Average sample from the 5-foot clay above the coal. Collected by A. R. Crandall, June 19, 1891. A soft, shaly clay, colored black by carbonaceous matter. It calcines to a light reddish tint and fuses slightly before the blowpipe.

COMPOSITION, AIR-DRIED.

Silica	62.36
Alumina	20.71
Iron peroxide.....	3.11
Lime	0.45
Magnesia	0.36
Potash	2.31
Sulphur	0.78
Water, volatile matter, etc. (ignition).....	10.30
Total	100.38

Part of the iron present is in the form of sulphide.

BELL COUNTY LIMESTONES.

No. 3097—Subcarboniferous limestone from Pineville Gap, Bell county, Ky., brought by A. R. Crandall, April 18, 1890. Formation about 300 feet thick.

A dark gray, compact stone, with broad conchoidal fracture.

No. 3098—St. Louis limestone, from Pineville Gap, Bell county, Ky. Brought by A. R. Crandall, April 18, 1890.

A very light gray, compact stone.

No. 3099—Limestone from Pineville Gap, Bell county, Ky. Brought by A. R. Crandall, April 18, 1890.

A compact, gray stone, part light and part dark, with small crystalline scales.

COMPOSITION OF THESE BELL COUNTY LIMESTONES, AIR-DRIED.

Number	3097	3098	3099
Lime carbonate.....	83.761	78.137	90.860
Magnesia carbonate.....	4.871	14.128	3.768
Alumina, and iron and manganese oxides....	1.120	2.180	1.200
Phosphoric acid	Trace	Trace	Trace
Lime sulphate.....	0.571	0.379	0.660
Silica and insoluble silicates.....	5.980	4.080	2.340
Moisture and loss.....	3.697	1.096	1.172
Totals	100.000	100.000	100.000
Percent of lime.....	45.46	43.89	51.15

BELL COUNTY IRON ORE.

No. 3100—Stalactitic limonite from Pine Mountain, Bell county, Ky. Sent by Frederick A. Hull, Pineville. Sample brought by A. R. Crandall, April 18, 1890.

COMPOSITION OF THE AIR-DRIED ORE.

Iron peroxide.....	78.68
Alumina	3.38
Carbonate of lime.....	0.68
Magnesia	A trace
Phosphoric acid.....	0.30
Sulphuric acid.....	0.34
Silica	6.64
Water, etc.	9.98
Total	100.00
Percentage of iron	55.08
Percentage of phosphorus	0.13
Percentage of sulphur	0.14

BOYD COUNTY COAL.

No. 3101—Coal, labeled “Keyes Creek coal, Little Hood creek, Boyd county, Ky. Bed 47 inches thick. Average of the whole face of the bed. Collected by A. R. Crandall, July 10, 1890.”

COMPOSITION OF THE AIR-DRIED COAL.

Hygroscopic moisture.....	4.60
Volatile combustible matter.....	35.06
Coke	60.34
Total	100.00
Total volatile matter.....	39.66
Carbon in the coke.....	56.34
Ash	4.00
Total	100.00
Character of the coke.....	Dense, spongy
Color of the ash.....	Gray-brown
Percentage of sulphur.....	1.70

BOYD COUNTY CLAYS.

No. 3102—Indurated clay, labeled “Bear Run, Boyd county, Ky. Bed 3 to 4 feet thick.” Brought by A. R. Crandall, August 1, 1890.

A gray clay. Calcines to a flesh color and is refractory before the blowpipe. Plastic with water when pulverized.

No. 3103—Clay, labeled “Hood Creek clay, 2½ feet thick, above limestone iron ore, Boyd county, Ky.” Brought by A. R. Crandall, August 1, 1890.

The clay is of a light gray color and is plastic with water when pulverized. It calcines nearly white, and is refractory in the blowpipe flame.

No. 3104—Indurated clay, labeled “Near Summit Station, on Hood creek, Boyd county, Ky. Bed 1½ feet thick.” Brought by A. R. Crandall, August 1, 1890.

The clay is plastic when ground, refractory, and calcines nearly white (light, reddish grey).

No. 3105—Indurated clay, labeled “Top of hill, one mile north of Ashland, Boyd county, Ky. Bed 5 feet thick. Collected by A. R. Crandall, November, 1890.”

The clay is of a light buff color.

No. 3106—Indurated clay, labeled “Fire-clay, 58 inches thick, under yellow kidney iron ore, on land of Mr. Geiger. Flat woods east of Ashland, Boyd county, Ky. Collected by A. R. Crandall, November 7, 1890.”

Sample a dark gray clay.

No. 3107—Fire-clay from a bank within the corporate limits of Ashland, Boyd county, Ky., which has been used for several years in the manufacture of fire-bricks on a large scale. Sample from two strata separated by a 4-foot stratum of limestone. The upper bed is 4½ feet and the lower 4 feet thick. Sample sent by Willis L. Ringo.

The clay burns nearly white or slightly pinkish, but fuses in the extreme heat of the blowpipe flame. It would probably make good common pottery ware.

No. 3108—Fire-clay, "Plastic or No. 2," from the middle of a 4½-foot bed below the limestone situated within the city limits of Ashland, Boyd county, Ky. (See No. 3107.)

The clay is of a light grey color. It burns nearly white and fuses very slightly in the blowpipe flame.

COMPOSITION OF THESE BOYD COUNTY CLAYS, AIR-DRIED.

Number ...	3102	3103	3104	3105	3106	3107	3108
Silica	65.88	64.58	58.18	59.34	59.62	40.14	56.40
Alumina ...	27.26	26.78	29.98	{ 30.62	{ 29.96 }	43.72	28.00
Iron oxide..	Trace	Trace	Trace			1.98	Trace
Lime	Trace	Trace	0.38	0.67	1.40	0.80	0.60
Magnesia ..	Trace	Trace	Trace	0.29	0.40	0.80	0.70
Potash	0.89	0.39	1.54	1.74	0.77	1.42	2.51
Water, etc..	5.97	8.25	9.92	7.34	7.85	11.14	11.79
Totals ...	100.00	100.00	100.00	100.00	100.00	100.00	100.00

BREATHITT COUNTY COALS.

No. 3109—Cannel coal, from George's branch, near Jackson, Breathitt county, Ky. (Coal No. 4 of the Geological Survey.) Average sample sent by Chas. Hendrie, September 28, 1891, from an opening driven 120 feet. The section is: Coal, 12 inches; splint coal, 6 inches; cannel coal, 18 inches.

An exceedingly tough, elastic coal, compact and uniform in structure.

No. 3110—Cannel coal from Joe Little's bank, on North Fork of Kentucky river, Breathitt county, Ky. Coal, 7 inches; cannel coal, 21 inches. Sample sent by Charles Hendrie.

No. 3111—Cannel coal, an outcrop sample from Sewell and Little's land, on Noble's branch of Troublesome creek, Breathitt county, Ky. From earth outcrops in branch. (No. 4 coal of the Geological Survey.) Coal, 12½ inches; cannel coal, 23 inches. Sample sent by Charles Hendrie.

COMPOSITION OF THESE BREATHITT COUNTY COALS, AIR-DRIED.

Numbers	3109	3110	3111
Hygroscopic moisture	0.50	0.10	0.70
Volatile combustible matters	58.02	62.42	50.90
Coke	41.48	37.48	48.40
Total.....	100.00	100.00	100.00
Total volatile matters	58.52	62.52	51.60
Carbon in the coke.....	34.00	31.48	36.70
Ash	7.48	6.00	11.70
Total.....	100.00	100.00	100.00
Character of the coke	Friable	Dense	Dense
Color of the ash	Grey	Reddish brown	Grey
Percentage of sulphur.....	1.098	.969	3.845

BRECKENRIDGE COUNTY CLAYS.

No. 3112—Soft clay, from near the edge of the town of Hardinsburg, Breckenridge county, Ky., on the Hartford and Leitchfield road, at the edge of a gully. Sent by G. W. Beard.

Refractory before the blowpipe; calcines to a very light gray color.

No. 3113—Hard clay from the same locality as the preceding. Sent by G. W. Beard.

A dark gray, indurated clay, in thin laminæ. Refractory before the blowpipe; calcines to a light pink color.

COMPOSITION OF THESE BRECKENRIDGE COUNTY CLAYS, AIR-DRIED

Number	3112	3113
Silica	64.02	59.34
Alumina, iron oxide, etc.	27.22	28.56
Lime	1.02	1.40
Magnesia	0.46	0.86
Potash	1.35	0.85
Water, etc.	5.93	8.99
Totals	100.00	100.00

BRECKENRIDGE COUNTY BITUMINOUS SANDSTONE.

No. 3114—"Asphalt rock," from Garfield, Breckenridge county, Ky. Collected by J. B. Hoeing.

The following results were obtained by burning a weighed portion of the sample:

Fine, white sand.....	98.55
Bituminous matter.....	1.45
Total	100.00

CALDWELL COUNTY IRON ORE.

No. 3115—Hematite iron ore found on Louis Davis's land, 1½ miles south of Crider's Station, O. V. R. R., Caldwell county, Ky. Sample from a bed of large extent, undeveloped. Sample shows the condition of the ore at 4 feet below the surface. Geological position, St. Louis limestone. Collected by E. O. Ulrich, December 4, 1889.

A dense, reddish-brown ore. The powder is a handsome red color.

COMPOSITION, AIR-DRIED.

Iron peroxide	50.27
Alumina	0.34
Phosphoric acid.....	0.85
Sulphur	A trace
Silica	37.80
Water, etc.	10.74
Total	100.00
Percentage of iron.....	35.19
Percentage of phosphorus.....	0.37

CALDWELL COUNTY CLAY.

No. 3116—"Fire-clay," ½ mile west of Tradewater Bridge, Dawson's junction of Princeton road, Caldwell county, Ky. Lower coal measures; 3 feet 1 inch coal above this. Collected by E. O. Ulrich, 1889.

A very light, brownish-gray clay; burns to a light pinkish color and is refractory in the blowpipe flame.

COMPOSITION, AIR-DRIED.

Silica	67.32
Alumina	23.56
Iron peroxide.....	A trace
Lime	0.34
Magnesia	0.42
Potash	2.08
Water, etc.	6.28
Total	100.00

CARTER COUNTY CLAYS.

No. 3117—Red indurated clay or “mineral paint,” sent by A. M. Henderson, Olive Hill, Ky. Sample from a bed at least 6 feet thick, about $1\frac{1}{2}$ miles north of the N. N. & M. V. Railroad. Above the clay is about 30 feet of limestone.

A reddish-brown clay, very plastic and quite refractory. Analysis proved it to contain 8.06 per cent. of iron peroxide.

This clay might answer for red pottery, for building brick, or for a cheap red paint.

No. 3118—Light bluish-gray or nearly white indurated clay, sent by A. M. Henderson at the same time with No. 3117.

This clay gave a slightly greenish powder, and was found to be quite refractory.

No. 3119—Clay, “from a bed about 6 feet wide and 10 feet deep,” on the southeast side of a ridge three miles northwest of Olive Hill, Carter county, Ky. Sample sent by A. M. Henderson, October, 1890.

A light brownish-yellow clay; calcines of a light red color. Would make a cheap red paint or terra cotta.

No. 3120—Fire-clay, from land at Grahn’s Station, Carter county, Ky., owned by R. B. Grahn. Sample from K. B. Grahn, November, 1891.

A dark grey indurated clay, refractory before the blowpipe; calcines white.

No. 3121—Fire-clay, from land at Grahn's Station, Carter county, Ky. Sample from K. B. Grahn, November, 1891.

A dark grey, indurated clay; refractory before the blowpipe; calcines white.

COMPOSITION OF THESE CARTER COUNTY CLAYS, AIR-DRIED.

Number	3118	3119	3120	3121
Silica	68.00	54.24	47.20	45.40
Alumina	20.00	35.08	39.90	40.04
Iron peroxide.....	3.96	1.17	Trace	Trace
Lime	0.45	Trace	Trace	Trace
Magnesia	0.47	0.60	Trace	Trace
Potash	3.25	2.86	Trace	Trace
Soda .....	.....	.....	0.21	0.21
Water and loss.....	3.87	6.44	12.69	14.35
Totals	100.00	100.00	100.00	100.00

The iron in the bluish clay, No. 3118, is in the ferrous condition.

CARTER COUNTY FIRE BRICK.

No. 3122—Fire brick, made from the clay at Grahn's Station, Carter County, Ky. (See Nos. 3120 and 3121.) This brick was made at the fire brick works in Louisville owned by Mr. R. B. Grahn. The brick was nearly white, being of a very light brownish-grey color and quite heavy, but not very tough. It was quite refractory before the blowpipe.

COMPOSITION, WATER-FREE.

Silica	52.79
Alumina	46.97
Iron peroxide	A trace
Lime and magnesia.....	Traces
Soda and potash.....	0.24
Total	100.00

CARTER COUNTY COALS.

No. 3123—Coal, from Lexington and Carter County Mining Co., near Mt. Savage, Carter county, Ky. Upper layer about 12 inches thick. Sample from the upper layer, about 12 inches thick, separated from the lower layer by a 4-inch clay parting. This is coal No. 3 of Dr. Owen. Brought by Jos. S. Woolfolk, April 16, 1890.

The coal cleaves in thin layers, with fibrous coal between. No pyrites apparent.

No. 3124—Coal, from Lexington and Carter County Mining Co., near Mt. Savage, Carter county, Ky. Sample from the lower layer. Brought by Jos. S. Woolfolk, April 16, 1890.

A pure looking coal; part cleaves in thin layers with fibrous coal between; part is more solid, bright and pure looking.

COMPOSITION OF THESE CARTER COUNTY COALS, AIR-DRIED.

Numbers	3123	3124
Hygroscopic moisture.....	4.80	3.90
Volatile combustible matters.....	36.20	34.90
Coke	59.00	61.20
Totals	100.00	100.00
Total volatile matters	41.00	38.80
Fixed carbon in the coke.....	54.36	52.38
Ash	4.64	8.82
Totals	100.00	100.00
Percentage of sulphur.....	0.549	0.618
Character of the coke.....	Densespongy	Densespongy
Color of the ash.....	White	White

CARTER COUNTY IRON ORE.

No. 3125—Iron ore, from land of Frank Maddix, Sinking Creek, Carter county, Ky. "The ore bed is of sufficient thickness

to work profitably if a good ore." Sample sent by J. M. Bent, Saulsbury, Ky., April 18, 1891.

COMPOSITION, AIR-DRIED.

Silica	34.00
Alumina	3.35
Iron peroxide.....	47.34
Lime	A trace
Magnesia	0.43
Phosphoric acid.....	1.53
Manganese brown oxide.....	0.31
Water and undetermined.....	13.04
Total.....	100.00

CLARK COUNTY LEAD ORE.

No. 3126—Galena, with some barite and calc spar, from Ford, Clark county, Ky. Sent by James McGilvery, April 28, 1890.

Tests in the wet way showed no silver.

CLAY COUNTY COALS.

No. 3127—Coal, from Blue-hole branch of Red Bird, about $1\frac{1}{2}$ miles from mouth, near the mouth of Boar Wallow branch, Clay county, Ky. Sample from $31\frac{1}{2}$ -inch outcrop; no parting. Collected by G. M. Sullivan, October 24, 1890.

No. 3128—Cannel coal, from Elisha's creek, $\frac{1}{2}$ mile from mouth, a tributary of Red Bird, Clay county, Ky. Sample from the cannel part of the bed, 12 inches thick. Splint and cannel, whole face, is 31 inches. Collected by G. M. Sullivan, October 13, 1890.

No. 3129—Coal, near mouth of Left Fork of Ulysses Fork of Big creek, Clay county, Ky. Sample from badly weathered outcrop. Bed, 38 inches. This coal is known as the "Fire-clay bed." Collected by G. M. Sullivan, December 13, 1890.

COMPOSITION OF THESE CLAY COUNTY COALS, AIR-DRIED.

Number	3127	3128	3129
Hygroscopic moisture	1.20	0.60	5.80
Volatile combustible matters	29.80	49.20	27.84
Coke	69.00	50.20	66.36
Totals	100.00	100.00	100.00
Total volatile matters	31.00	49.80	33.64
Fixed carbon in the coke	65.00	43.00	55.16
Ash	4.00	7.20	11.20
Totals	100.00	100.00	100.00
Percentage of sulphur	.755	.483	.526
Character of the coke	Dense	Very dense	Pulverulent
Color of the ash	Light brown- ish grey	Light brown- ish grey	Light grey

CLAY COUNTY MINERAL WATER.

No. 3130—Mineral water, from a spring on Big Wildcat branch, a tributary of the East Fork of Goose creek, about 2½ miles south from the mouth of Red Bird creek, Clay county, Ky. Sample sent by B. F. White from East Bernstadt, and received May 8, 1891. The water is believed to possess extraordinary medicinal properties.

The water was found to contain, in 1,000 parts, only 0.268 part of total saline matter, composed of chloride of sodium, sulphate of soda and carbonate of soda, with only traces of lime and magnesia.

This is a remarkably pure and wholesome water, slightly alkaline in its reaction, but is hardly entitled to be called a mineral water, on account of the small amount of mineral matter it contains.

CRITTENDEN COUNTY MARLS.

No. 3131—Green marl, from King's Station, O. V. R. R., Crittenden county, Ky. Bed 7 feet thick. Top of Chester group,

underlying limestones of Giles' quarry. (Same bed sampled in Caldwell county.) Collected by E. O. Ulrich, November 7, 1889.

A shaly clay of a dull greenish-grey color.

No. 3132—Green marl, on Wm. Wilson's land, $3\frac{1}{4}$ miles west of Marion, on the line of proposed railroad, Crittenden county; underlying 20 inches of oolitic limestone. Bed above and below limestone aggregating 10 feet or more. Geological position, Chester group. Collected by E. O. Ulrich, November 18, 1889.

A greenish-grey, shaly clay, plastic, and calcines to a light pink color at a moderate heat. Before the blowpipe it fuses to a light green-grey slag.

No. 3133—Marl, mixed sample of the green and purple marls, from King's Station, O. V. R. R., Crittenden county, Ky., showing their character after exposure to the weather for months. Thickness of entire bed over 10 feet. The marl is beneath the limestone of Giles' quarry. Geological position, upper part of Chester group. Collected by E. O. Ulrich, November 7, 1889.

No. 3134—Purple marl, from King's Station, O. V. R. R., Crittenden county, Ky., underlying the green marl and the limestone of Giles' quarry. (Same bed sampled in Caldwell county.) Bed 3 feet or more thick. Bottom not seen. Top of Chester group. Collected by E. O. Ulrich, November 7, 1889.

COMPOSITION OF THESE CRITTENDEN COUNTY MARLS.

Number	3131	3132	3133	3134
Silica	61.160	54.160	53.420	53.420
Alumina and iron oxide	22.449	25.613	28.493	31.493
Lime carbonate	1.200	2.500	0.800	0.600
Magnesia carbonate	2.013	4.540	0.878	0.605
Potash	3.514	3.348	4.749	2.432
Phosphoric acid	0.511	0.767	0.767	0.767
Water, loss, etc.	9.153	9.072	10.893	10.683
Totals	100.000	100.000	100.000	100.000

CRITTENDEN COUNTY CLAYS.

No. 3135—Clay; a very tough clay that overlies the ochre, 4 feet thick in the shaft, 5 miles southwest of Marion, on the Wallace Ferry road, Crittenden county, Ky. Geological position, Chester. Collected by E. O. Ulrich, October 18, 1889.

The clay was found to be quite refractory before the blowpipe.

No. 3136—Red clay, exposed on the road-side near Salem church, Crittenden county, Ky. Collected by E. O. Ulrich, 1889.

The clay is of a handsome pink color. Before the blowpipe it fuses with difficulty, burning to a brownish-red color.

COMPOSITION, AIR-DRIED.

Number	3135	3136
Silica	56.980	74.360
Alumina	32.044	} 16.180
Iron peroxide.....	0.026	
Lime	0.013	0.448
Magnesia	0.648	0.360
Potash	2.247	0.772
Water, etc.	8.042	7.880
•Totals	100.000	100.000

The red clay would answer for making a cheap paint, bricks or common red pottery.

CRITTENDEN COUNTY ZINC AND LEAD ORES.

No. 3137—Zinc ore, from the Tabb mine, 3 miles from Anora Station, Crittenden county, Ky. Geological position, St. Louis group. Sample sent by Jno. R. Procter, November 24, 1891.

The sample was examined for zinc only, and was found to contain 2.27 per cent. of that metal.

No. 3138—Lead ore, from the La Rue mine, $3\frac{1}{2}$ miles southwest of Crittenden Springs, Crittenden county, Ky. Geological position, between the St. Louis and the Chester. Collected from a lot of ore that was mined for silver, by E. O. Ulrich.

COMPOSITION, AIR-DRIED.

Lead sulphide	29.50	containing 25.55 lead
Silica	17.89	
Alumina and other ingredients.....	N. E.	
No. silver detected.		

DAVIESS COUNTY CLAY.

No. 3139—Indurated clay, from J. H. Rudy's farm, $3\frac{1}{2}$ miles west of Owensboro, Daviess county, Ky. The extent of deposit is large and its thickness more than 4 feet. Sent by the Hon. J. H. Rudy, June, 1890.

A dark grey, indurated clay, colored with carbonaceous matter. It calcines to a very light brownish-grey color and fuses slightly before the blowpipe.

COMPOSITION, AIR-DRIED.

Silica	51.580
Alumina	23.890
Iron peroxide.....	4.730
Lime	1.277
Magnesia	2.016
Potash	2.270
Water, undetermined, etc.	14.233
Total.....	100.000

This clay would make good bricks for street paving, etc.

DAVIESS COUNTY MINERAL WATERS.

No. 3140—Water from a spring in Whitesville, Daviess county, Ky., sent by Hon. R. S. Triplett, May 14, 1891.

The water was clear, without any decided smell or taste. 1,000 parts, upon evaporation, left 0.2 part solid matter, equivalent to 11.7 grains to the gallon, composed of calcium sulphate

and calcium carbonate, with only traces of chlorides. The sulphuric acid in sulphate was found to be .0686 part in 1,000 parts of the water.

No. 3141—Mineral water, from "South Park Mineral Well," in the suburbs of Owensboro, Daviess county, Ky., on a lot owned by O. T. Kendall. The flow is said to be abundant. Sample sent by W. T. Courtney, of Owensboro, August, 1891.

COMPOSITION IN 1000 PARTS OF THE WATER.

Iron carbonate.....	0.026
Lime carbonate.....	0.108
Magnesia carbonate.....	0.051
Lime sulphate.....	0.041
Magnesia sulphate.....	0.081
Soda sulphate.....	0.134
Sodium chloride.....	0.015
Silica	0.017
Total solid matters.....	0.473

ESTILL COUNTY CLAY.

No. 3142—Fire-clay, on Rice's farm, 4 miles from Irvine, Estill county, Ky. The bed is 2 to 4 feet thick. Sample sent by Capt. John Abraham, February, 1890.

A nearly white, indurated clay. It burns white and is quite refractory.

COMPOSITION, AIR-DRIED.

Silica	63.80
Alumina	25.60
Iron peroxide.....	A trace
Lime	0.34
Magnesia	0.76
Potash	3.05
Soda	A trace
Water, etc.	6.45
Total.....	100.00

FAYETTE COUNTY SUBSOIL OR BRICK CLAY.

No. 3142½—Subsoil or clay, used for making ordinary red building brick, from J. B. Wilgus' brick-yard, on the Newtown road, near the city limits of Lexington, Fayette county, Ky. Sample collected by Dr. Robert Peter, March, 1890.

COMPOSITION, AIR-DRIED.

Silica	45.34
Alumina	23.75
Iron peroxide.....	18.29
Lime	1.46
Magnesia	1.05
Potash	0.44
Phosphoric acid.....	0.90
Combined water, etc. (ignition).....	11.00
Total.....	101.93

This is the characteristic red subsoil of the Bluegrass region proper and contains much iron, part of it in the form of iron gravel or shot iron ore. It makes a very good red brick, and is used extensively for that purpose, most of the houses in Lexington being built of these bricks.

FLOYD COUNTY COALS.

No. 3143—Coal, 14 miles from mouth of Big Mud creek, Floyd county, Ky. Collected by A. R. Crandall, December, 1890. The section is: Coal, 7 inches; shale, 9 inches; coal, 42 to 45 inches. The sample is an average of the lower bench.

No. 3144—Coal, from Steven's branch of Beaver creek, Floyd county, Ky. Lower coal. Sample from two upper benches. Collected by A. R. Crandall, December, 1890. The section is: Coal, 16 inches; parting, 5 to 6 inches; coal, 34 inches; parting, 1 inch; coal, 2 inches; clay, 3 inches; coal, 6 inches.

No. 3145—Coal, from Left Fork of Beaver creek, 12 miles above the forks and 5 miles below the mouth of Jack's creek, Floyd county, Ky. Sample of the whole bed. Collected by A. R. Crandall, December, 1890. The section is: Coal, 15 inches; clay, 5 inches; coal, 38 inches.

No. 3146—Coal, on Caney Fork of Left Fork of Middle creek, Floyd county, Ky. Average sample from the 6-foot 8-inch face without parting. Collected by A. R. Crandall, December 9, 1890.

No. 3147—Coal, from head of Mud creek, Floyd county, Ky. Average sample of the whole bed. Collected by A. R. Crandall, December 11, 1890. The section is: Coal, 25 inches; shale, 3 to 4 inches; coal, 28 inches.

COMPOSITION OF THESE FLOYD COUNTY COALS, AIR-DRIED.

Number	3143	3144	3145	3146	3147
Hygroscopic moisture	1.06	1.60	4.68	2.66	1.20
Volatile combustible matters ..	33.40	34.10	30.06	33.74	33.36
Coke	65.54	64.30	65.26	63.60	65.44
Totals	100.00	100.00	100.00	100.00	100.00
Total volatile matters	34.46	35.70	34.74	36.40	34.56
Fixed carbon in the coke	56.54	57.70	62.14	57.80	62.04
Ash	9.00	6.60	3.12	5.80	3.40
Totals	100.00	100.00	100.00	100.00	100.00
Percentage of sulphur	.719	.412	.439	.439	.439
Character of the coke	Light spongy	Light spongy	Pulveru- lent	Light spongy	Spongy
Color of the ash	Light grey	Very lt. grey	Light pink	Light grey	Very lt. grey

No. 3148—Coal, from the Left Fork of Beaver creek (Minnie P. O.), Floyd county, Ky. Average sample from the 40-inch face; no parting. Collected by A. R. Crandall, December 10, 1890.

No. 3149—Coal, from head of Daniel's creek, Floyd county, Ky. Average sample of the upper 15 inches, collected by A. R. Crandall, August 18, 1891. The section is: Coal, 15 inches; clay, 5 inches; coal, 54 inches.

No. 3150—Coal from head of Daniel's creek, Floyd county, Ky. Average of the lower bench, 54 inches. Collected by A. R. Crandall, August, 1891.

COMPOSITION OF THESE FLOYD COUNTY COALS, AIR-DRIED.

Number	3148	3149	3150
Hygroscopic moisture	1.80	4.00	4.46
Volatile combustible matters	32.76	28.78	28.32
Coke	65.44	67.22	67.22
Totals	100.00	100.00	100.00
Total volatile matters	34.56	32.78	32.78
Fixed carbon in the coke	58.44	58.54	58.42
Ash	7.00	8.68	8.80
Totals	100.00	100.00	100.00
Percentage of sulphur	.467	.494	.385
Character of the coke	Spongy	Dense	Dense friable
Color of the ash	Very light grey	Light grey	Light grey

FRANKLIN COUNTY IRON ORE.

No. 3151—Iron ore, from a farm about 12 miles from Frankfort, Franklin county, Ky. Impure limonite in thin layers. Analysis showed 14.4 per cent. of iron in the air-dried ore, equivalent to 20.6 per cent. peroxide of iron. It is of no value as an ore.

FULTON COUNTY MINERAL WATER.

No. 3152—Mineral water, from well 213 feet deep, 2 inches in diameter, on the premises of Mr. Morris, Hickman, Fulton county, Ky. Sent by Jno. W. Morris, August 22, 1892.

COMPOSITION IN 1000 PARTS OF THE WATER.

Iron carbonate.....	0.011	} Held in solution by carbonic acid.
Lime carbonate.....	0.243	
Magnesia carbonate.....	0.053	
Lime sulphate.....	Trace	
Magnesia sulphate.....	Trace	
Sodium chloride.....	0.050	
Potassium chloride.....	Trace	
Silica	0.020	

Total..... 0.377

A weak chalybeate water and quite wholesome.

GRAVES COUNTY MINERAL WATERS.

No. 3153—Mineral water, from Adelida Springs (No. 1), on the land of Jno. W. Morris, Esq., in the southeastern corner of Graves county, Ky. Outflow about 60 gallons per hour. Color of the sediment when first found, bright greenish-yellow, turning to reddish-brown on longer exposure; sediment abundant. Sample sent by A. M. Kirkland, manager, Farmington, Ky., July, 1890.

The bottle contained some reddish sediment.

No. 3154—Mineral water, from Adelida Springs (No. 2), same locality as No. 3153. Outflow about 35 gallons per hour. Color of sediment somewhat green, with a yellowish tint; sediment sparse. Sample sent by A. M. Kirkland, manager, Farmington, Ky., July, 1890.

There was some sediment in the bottle.

COMPOSITION OF THESE GRAVES COUNTY WATERS IN 1000 PARTS.

Number	3153	3154
Carbonate of iron.....	0.0289	0.0200
Carbonate of lime.....	0.0114	0.0178
Carbonate of magnesia.....	0.0059	0.0100
Chloride of sodium.....	Trace	Trace
Silica	0.0338	0.0300
Total solid matters.....	0.0800	0.0778

These are good, mild chalybeate waters, but should be used fresh at the springs.

GRAVES COUNTY CLAY.

No. 3155—Clay, from a bed on the south side of the line of the N. N. & M. V. R. R., $1\frac{1}{2}$ miles east of Pryorsburg, Graves county, Ky., owned by the Kentucky Construction and Improvement Company. The section shows 8 to 10 feet down from the surface, sand and gravel with iron, thence downward 40 feet

of clay in eight slightly differing strata, below which is gravel mixed with small boulders. The sample is an average, consisting of chippings from the entire column of 40 feet of clay. Sent by S. W. Cooley, president of the company, March 2, 1892.

The clay is quite refractory before the blowpipe and calcines pure white.

COMPOSITION, AIR-DRIED.

Silica	56.40
Alumina	30.00
Lime	0.40
Magnesia	A trace
Potash	3.26
Moisture, combined water, etc.	9.94
Total	100.00

GREENUP COUNTY COALS.

No. 3156—Cannel coal, from the Hunnewell mines, Greenup county, Ky. Sample sent by H. W. Bates, July, 1892.

No. 3157—Cannel coal, from the Hunnewell cannel mines, Greenup county, Ky. Sent by H. W. Bates.

COMPOSITION OF THESE GREENUP COUNTY COALS, AIR-DRIED.

Number	3156	3157
Hygroscopic moisture	2.00	2.40
Volatile combustible matters.....	48.20	52.60
Coke	49.80	45.00
Totals	100.00	100.00
Total volatile matters	50.20	55.00
Fixed carbon in the coke	41.80	38.00
Ash	8.00	7.00
Totals	100.00	100.00
Percentage of sulphur.....	1.37	1.37
Character of the coke.....	Friable	Friable
Color of the ash.....	Light grey	Light grey

HANCOCK COUNTY CLAYS.

No. 3158—Clay, from the farm of D. C. Adair, 5 miles above Hawesville, Hancock county, Ky. The bed is over 6 feet thick, and has been traced over 40 acres. Sample sent by Mr. Adair.

A light gray clay, quite plastic, but fuses slightly before the blowpipe.

No. 3159—Indurated clay, from the farm of D. C. Adair, 5 miles from Hawesville, Hancock county, Ky. The bed is 8 or 10 feet thick. Sample sent by Mr. Adair.

The clay is quite plastic, of a light grey and light greyish-brown color. It fuses slightly before the blowpipe.

COMPOSITION OF THESE HANCOCK COUNTY CLAYS, AIR-DRIED.

Number	3158	3159
Silica	41.60	56.52
Alumina	22.76	23.96
Iron peroxide.....	2.78	2.78
Lime carbonate.....	21.22	2.90
Magnesia carbonate.....	1.00	2.00
Potash	Trace	Trace
Soda	0.10	0.16
Moisture, etc.	10.54	11.68
Totals	100.00	100.00

No. 3157—May be called a marl. The clay, No. 3158, withstands a white heat without fusing.

HARDIN COUNTY MINERAL WATERS.

No. 3160—Sulphur water, from a gas well in Hardin county, Ky., 315 feet deep, in the lower part of the black shale. Outflow 20 to 30 barrels per day, thrown 3 to 50 feet by gas. "The water has a strong smell of sulphur and turns everything black it falls upon." Sample sent by J. W. Applegate, West Point, Ky., September, 1890.

COMPOSITION IN 1000 PARTS.

Carbonic acid gas, small proportion.....	N. E.	} Held in solution by carbonic acid.
Hydrogen sulphide gas, small proportion.....	N. E.	
Iron sulphide.....	0.004	
Lime carbonate.....	1.255	
Magnesia carbonate.....	0.622	
Sodium chloride.....	18.140	
Potassium chloride.....	A trace	
Calcium chloride.....	1.394	
Magnesium chloride.....	0.445	
Silica	0.010	
Total saline matters.....		21.870

This is a saline sulphur water containing a small proportion of iron sulphide. On exposure to the air the iron salt is speedily thrown down.

No. 3161—Chalybeate water, from “Sylvan Spring,” at East View, Hardin county, Ky., $1\frac{1}{2}$ miles from Bethesda Spring (see No. 3162). Sample sent by Dr. E. M. Berry, February, 1891, who says it is “diuretic and has been used with success in the cure of various diseases.”

There was a slight sediment in the bottle.

No. 3162—Chalybeate water, from Bethesda Spring, at East View, Hardin county, Ky., owned by Dr. E. M. Berry & Co. Outflow 20 barrels in 24 hours. A red sediment forms at spring. Dr. Berry says: “The water has a pleasant taste and is very conducive to health, acting as a diuretic, but it is not laxative.” Sample sent by Dr. Berry, February, 1891.

COMPOSITION IN 1000 PARTS OF THE WATER.

Number	3161	3162	
Iron carbonate.....	0.0210	0.0233	} Held in solution by carbonic acid.
Lime carbonate.....	0.0240	0.0683	
Magnesia carbonate	0.0270	0.0132	
Sodium chloride.....	0.0074	0.0060	
Potassium chloride.....	0.0076	0.0010	
Lime sulphate.....	0.0135	0.0138	
Magnesia sulphate.....	0.0486	0.0120	
Silica, etc.	0.0360	0.0212	
Total solid matters.....	0.1851	0.1588	

These are mild saline chalybeate waters. They soon lose their iron by exposure to the air, and should be drunk fresh from the springs.

No. 3163—Salt water, from a well 500 feet deep, at Elizabethtown, Hardin county, Ky. The sample was "taken from the top of the well, about 3 feet under ground, and had to force itself through a fresh water stream about 160 feet under ground. The supply is inexhaustible." Sent by G. R. Smith.

A slight ferruginous sediment had deposited in the bottle.

COMPOSITION IN 1000 PARTS OF THE WATER.

Iron carbonate.....	0.020	} Held in solution by carbonic acid.
Lime carbonate.....	0.752	
Magnesia carbonate.....	0.003	
Silica	0.009	
Sodium chloride.....	97.000	
Potassium chloride	N. E.	
Calcium chloride.....	19.692	
Magnesium chloride	4.524	
Magnesium sulphate	1.753	
Lime sulphate	0.941	
Silica	0.021	
Total saline matters.....	124.715	

HENRY COUNTY CLAY.

No. 3164—Clay, from near Gratz, Henry county, Ky. Sent by U. Keenon, March 14, 1890.

The clay is quite plastic, it calcines of a light gray color, and is quite refractory before the blowpipe, fusing only on thin edges.

COMPOSITION.

Silica	78.800
Alumina	11.400
Iron peroxide.....	A trace
Lime	0.082
Magnesia	0.570
Potash	1.700
Water and loss, etc.	7.448
Total.....	100.000

This clay contains a considerable proportion of fine sand. It would make good gray stoneware and ordinary fire-brick.

HICKMAN COUNTY MINERAL WATER.

No. 3165—Water, from a well in Hickman county, Ky., about 4 miles east of Columbus. Well 4 feet deep, in a bend of Bowles creek. The water runs over the curbing, about 3 feet over the level of the water in the creek, in a bold stream of, say, five gallons to the minute, clear as crystal and cold, forming on the sides of the curbing and bottom of the outlet a yellow deposit. Sent by Jno. H. Ellis, Columbus, September, 1890. Mr. Ellis had to stop using this water in his steam boiler on account of the heavy deposit it made.

COMPOSITION IN 1000 PARTS.

Carbonate of iron.....	0.0230	} Held in solution by carbonic acid
Carbonate of lime.....	0.1120	
Carbonate of magnesia.....	0.0300	
Chloride of sodium.....	0.0150	
Chloride of potassium.....	0.0110	
Sulphate of lime.....	0.0100	
Silica	0.0314	
Total solid matter.....	0.2224	

This is a weak chalybeate water.

HOPKINS COUNTY COAL.

No. 3166—Coal, from Hanson, Hopkins county, Ky. Bed 5 feet thick, at the foot of a very high hill, 40 feet from the top of the ground. Sent by J. R. Masencup, who says it is not an average sample, as presence of water prevented proper sampling.

COMPOSITION, AIR-DRIED.

Hygroscopic moisture.....	5.20
Volatile combustible matters.....	32.26
Coke	62.54
Total	100.00
Total volatile matters.....	37.46
Fixed carbon in the coke.....	42.04
Ash	20.50
Total	100.00
Percentage of sulphur.....	1.37
Character of the coke.....	Spongy
Color of the ash.....	Grey

HOPKINS COUNTY MINERAL WATERS.

No. 3167—Chalybeate water, from a well owned by Mrs. M. J. Almon, called “Dawson Spring,” at Dawson, Hopkins county, Ky. The well is 12 feet deep, at which depth a hard rock was struck, which was bored through and cemented tiling put in to keep out the surface water. Sample sent in March, 1891. The bottle contained a notable amount of ferruginous sediment.

No. 3168—Chalybeate water, from “Chapel Well,” or spring, at Dawson, Hopkins county, Ky. Sample sent by Jesse Chapel, May, 1891.

There was much ferruginous sediment in the bottle.

No. 3169—Chalybeate water, from “Summit Well,” owned by the Summit Hotel Company, Dawson, Hopkins county, Ky. Sent by F. L. Manley, proprietor, July 17, 1891.

The sample was taken after pumping for a day to clean out the well. The flow in pumping is 20 barrels or more a day.

COMPOSITION OF THESE HOPKINS COUNTY (DAWSON) CHALYBEATE WATERS IN 1000 PARTS.

Number	3167	3168	3169
Iron carbonate.....	0.133	0.5729	0.026
Lime carbonate.....	0.240	0.0160	0.042
Magnesia carbonate.....	0.172	0.0109	N. E.
Iron sulphate.....	0.092	.....	0.047
Lime sulphate.....	0.359	0.6124	0.042
Magnesia sulphate.....	0.200	0.0756	0.093
Soda sulphate.....	.....	0.0770	0.027
Sodium chloride.....	0.100	0.0640	0.039
Potassium chloride.....	Trace	Trace	Trace
Silica	0.035	0.0510	.....
Total saline matters.....	1.331	1.4798	0.316

Held in
solution by
carbonic
acid.

These are saline chalybeate waters, which soon lose their iron carbonate on exposure to the air.

JEFFERSON COUNTY CLAYS.

No. 3170—Indurated clay, from the Shively place, 500 feet east of the N. N. & M. V. R. R. track, 4 miles south of Louisville, Jefferson county, Ky. Bed 20 to 40 feet thick. Sent by H. P. McDonald, June, 1890.

A light gray, indurated clay; calcines a light brownish-gray color and fuses slightly before the blowpipe

No. 3171—Indurated clay, from McDonald Brick Co. Bed 125 feet thick, 6 miles from Louisville, Jefferson county, Ky., near the Salt River road. Sample sent by H. P. McDonald, November 6, 1890.

The clay is quite plastic when pulverized. It burned to a very light, warm gray color, but fused in the flame of the blowpipe.

COMPOSITION OF THESE JEFFERSON COUNTY CLAYS, AIR-DRIED.

Number	3170	3171
Silica	55.380	58.82
Alumina	28.093	23.72
Iron peroxide.....	0.047	3.56
Lime	0.549	Trace
Magnesia	1.615	1.44
Potash	3.475	4.75
Water, etc.	10.841	7.71
Totals	100.000	100.00

These clays would make good, hard brick for street paving. Mr. McDonald reported later that his company had succeeded in making pretty good pavers out of the clay No. 3171.

JESSAMINE COUNTY ZINC ORE.

No. 3172—Zinc sulphide, in calc spar and limestone, from a vein about 3 feet wide and $\frac{3}{4}$ of a mile in length, about $\frac{3}{4}$ of a mile from Camp Nelson, Jessamine county, Ky.

The sample is of opaque, white calc spar, and grey and

brownish limestone, containing dark colored zinc blende. There was no galena. The quantity of blende present was so small that it was not considered necessary to determine the percentage of zinc. If the ore is all of this character, it would not pay for working.

JOHNSON COUNTY COAL.

No. 3173—Coal, from Buffalo creek, Johnson county, Ky.
Sample sent by George Gillis.

A pure looking, bright coal.

COMPOSITION, AIR-DRIED.

Hygroscopic moisture.....	2.00
Volatile combustible matters.....	36.00
Coke	62.00
Total.....	100.00
Total volatile matters.....	38.00
Fixed carbon in the coke.....	55.00
Ash	7.00
Total.....	100.00
Percentage of sulphur.....	0.93
Character of the coke.....	Spongy
Color of the ash.....	White

KNOX COUNTY COAL.

No. 3174—Coal, labeled "Widow Dunsmore's Coal, at head of Harp's creek of Big Poplar creek, Knox county, Ky. Sample from the outcrop, 51½ inches, there being one inch of clay parting 6 inches from the top. This bed is generally known as the Dean coal. Collected by Geo. M. Sullivan, May 14, 1891.

COMPOSITION, AIR-DRIED.

Hygroscopic moisture.....	4.00
Volatile combustible matters.....	31.20
Coke	64.80
Total.....	100.00
Total volatile matters.....	35.20
Fixed carbon in the coke.....	59.00
Ash	5.80
Total.....	100.00
Percentage of sulphur.....	0.521
Character of the coke.....	Dense
Color of the ash.....	White

LARUE COUNTY WATER.

No. 3175—Water, from a new public well at Buffalo, Larue county, Ky. Sent by Drs. Jones and Beauchamp, of that place, July 30, 1892. The water has no marked taste or smell. It is neutral in reaction, and no iron was detected. Upon evaporation there remained 0.5 part of solid matter from 1,000 parts of water, composed of chloride of sodium, chloride of calcium, sulphate of soda, sulphate of lime and carbonate of lime.

LAUREL COUNTY MINERAL WATER.

No. 3176—Chalybeate water, from a spring about $2\frac{1}{2}$ miles from London, Laurel county, Ky. Sample sent by Sam'l Mori, Faristown, September 27, 1890. 1,000 parts of the water left, when evaporated, .09 part of solid matter, of which .029 was silica, the rest being mainly peroxide of iron, with traces of the carbonates of lime and magnesia.

This is a pure, very weak, chalybeate water.

Mr. Mori also sent some of the ferruginous sediment collected from the rocks over which the water flows. It was found to have the following composition, air-dried:



KENTUCKY GEOLOGICAL SURVEY.

49

Iron peroxide.....	0.0289
Silica	0.1531
Magnesia carbonate.....	0.0229
Lime carbonate.....	0.0211
Combined water, etc.	0.0400
Total.....	0.2860

LAWRENCE COUNTY CLAY.

No. 3177—Clay, from the Peach Orchard coal mines, Lawrence county, Ky., being the 6-inch parting in coal No. 3. Average from two points in entry No. 6, collected by A. R. Crandall, July 24, 1891.

The clay burns white and fuses slightly before the blowpipe.

COMPOSITION, AIR-DRIED.

Silica	55.60
Alumina	30.04
Lime	0.95
Magnesia	0.83
Potash	0.20
Moisture, etc.	12.38
Total	100.00

LAWRENCE COUNTY IRON ORE.

No. 3178—Iron ore, layer 6 inches thick at the top of Black Band, Three-mile creek, Lawrence county, Ky. Contains a notable quantity of coal.

Analysis gave 30 per cent. of iron, equivalent to 43 per cent. of peroxide of iron.

LAWRENCE COUNTY COALS.

No. 3179—Cannel coal, from Right Fork of Gavit branch of Levisa Fork of Big Sandy river, Lawrence county, Ky. Sample of the cannel coal layer, collected by A. R. Crandall, July 16, 1891.

No. 3180—Coal, labeled "Peach Orchard coal, Lawrence

county, Ky. (Coal No. 3), average sample from the lower bench, 21 inches, collected by A. R. Crandall, 1891."

No. 3181—Coal, labeled "Peach Orchard coal, Lawrence county, Ky." (Coal No. 3.) Average sample from the upper bench, 28 inches, in the left, No. 6, entry. Collected by A. R. Crandall, 1891.

No. 3181a—Coal, from Lawrence county, Ky., sent by Col. Jay H. Northup, 1891. Locality not given.

COMPOSITION OF THESE LAWRENCE COUNTY COALS, AIR-DRIED.

Number	3179	3180	3181	3181A
Hygroscopic moisture	3.50	4.52	3.00	2.20
Volatile combustible matters	44.98	34.68	35.60	53.52
Coke	51.52	60.80	61.40	44.28
Totals	100.00	100.00	100.00	100.00
Total volatile matters	48.48	39.20	38.60	55.72
Fixed carbon in the coke	44.72	56.80	57.80	40.28
Ash	6.80	4.00	3.60	4.00
Totals	100.00	100.00	100.00	100.00
Percentage of sulphur	.713	.521	.658	.879
Character of the coke	Pulverulent	Dense spongy	Dense spongy	Dense
Color of the ash	Red	Light grey	Light brown	Lt. brownish grey

LESLIE COUNTY CLAY.

No. 3182—Indurated clay, on Big creek, Leslie county, Ky. Bed 4-5 inches thick, immediately under the main coal of the Big creek region. Collected by A. R. Crandall, May, 1890.

The clay is plastic with water when pulverized, calcines white, and is refractory before the blowpipe.

COMPOSITION, AIR-DRIED.

Silica	49.960
Alumina	41.210
Peroxide of iron.....	A trace
Lime	0.380
Magnesia	0.138
Potash	0.231
Soda	0.228
Water and loss.....	7.853
Total	100.000

LESLIE COUNTY COALS.

No. 3183—Coal, near the mouth of Left Fork of Jack's creek, a branch of Red Bird, Leslie county, Ky. Average sample, collected by G. M. Sullivan, November 18, 1890. The section is: Coal, $15\frac{1}{2}$ inches; clay, $2\frac{1}{2}$ inches; bituminous shale, $1\frac{1}{2}$ inches; coal, 26 inches. The parting was excluded in sampling.

No. 3184—Coal, near the mouth of Oakley Cave branch of Left Fork of Jack's creek, Leslie county, Ky. Collected by G. M. Sullivan, November 15, 1890. The section is: Coal, $13\frac{1}{2}$ inches; clay, 1 inch; bituminous shale, $1\frac{1}{2}$ inches; coal, 24 inches. The sample represents the $40\frac{1}{2}$ inches of coal.

No. 3185—Coal, from Phillips' Fork of Red Bird, about $1\frac{1}{2}$ miles from the mouth, on the Matilda Asher place, Leslie county, Ky. Sample from the outcrop, taken from lower 44 inches, with one thin clay parting. Collected by G. M. Sullivan, October 18, 1890.

No. 3186—Coal, $\frac{1}{2}$ mile above the mouth of Right Fork of Jack's creek, of Red Bird, Leslie county, Ky. Collected by G. M. Sullivan, November 18, 1890. The section is: Coal, 7 inches; knife-edge of clay; coal, 10 inches; shale, $1\frac{1}{4}$ inches; coal, 2 inches; clay, $1\frac{1}{2}$ inches; coal, 29 inches. Sample represents the 48 inches of coal.

No. 3187—Coal, from Howell Fork of Big creek, Leslie county, Ky. Average sample from 54 inches of coal, without parting. Collected by A. R. Crandall, May 22, 1890.

No. 3188—Coal, near head of Spruce Pine branch of Sugar creek, Leslie county, Ky. Whole bed, 97 inches. Average sample from the lower 55 inches. Collected by A. R. Crandall, May 23, 1890.

COMPOSITION OF THESE LESLIE COUNTY COALS, AIR-DRIED.

Number	3183	3184	3185	3186	3187	3188
Hygroscopic moisture	1.20	1.04	0.74	0.74	2.98	1.80
Volatile combustible matters...	27.88	33.36	32.90	33.86	33.98	34.00
Coke	70.92	65.60	66.36	65.40	63.04	64.20
Totals	100.00	100.00	100.00	100.00	100.00	100.00
Total volatile matters	29.08	34.40	33.64	34.60	36.96	35.80
Fixed carbon in the coke	64.92	59.68	58.44	57.48	59.98	57.06
Ash	6.00	5.92	7.92	7.92	3.06	7.14
Totals	100.00	100.00	100.00	100.00	100.00	100.00
Percentage of sulphur	.721	.357	.892	.532	.404	.742
Character of the coke	Dense	Spongy	Spongy	Spongy	Spongy	Spongy
Color of the ash	Very lt grey	Grey	Lt. grey	Lt. grey	Brownish grey	Lt. grey

LIVINGSTON COUNTY CLAY.

No. 3189—Clay, from a cave in Livingston county, Ky., near the Cumberland river, several miles below Grand Rivers. Sent by W. F. Bradshaw, Paducah, Ky., January 18, 1892.

A brownish-red indurated clay, quite plastic with water.

COMPOSITION, AIR-DRIED.

Silica and insoluble silicates (containing 41.4 silica).....	64.96
Alumina	5.02
Iron peroxide.....	10.32
Lime	2.23
Magnesia	Trace
Moisture, etc.	17.47

Total	100.00
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MAGOFFIN COUNTY COALS.

No. 3190—Henry Mays' coal, on Burton Fork of Slate Road Fork of Licking river, Magoffin county, Ky. Average sample from all but the cannel portion. Collected by A. R. Crandall, October 26, 1891. The section is: Coal, $18\frac{3}{4}$ inches; bone and parting, 3 to 4 inches; coal, 24 inches; cannel coal, 7 inches; coal, 1 inch.

No. 3191—Cannel coal, sample from the 7-inch layer of cannel coal at the bottom of Henry May's coal (see No. 3190), on Burton Fork. Collected by A. R. Crandall, October 26, 1891.

No. 3192—Shepard's coal, head of Licking river, Magoffin county, Ky. Average from the outcrop, imperfectly sampled. Collected by A. R. Crandall, October 22, 1891. The section is: Coal, 21 inches; parting, $\frac{1}{2}$ inch; coal, 25 inches; parting, 1 inch; coal, 11 inches; parting, 1 inch; coal, 8 inches.

No. 3193—Coal, at head of Right Fork of Middle Fork of Licking river, Magoffin county, Ky. Average sample from 47-inch face; 6 to 7 inches of soft coal at the top. Collected by A. R. Crandall, October 21, 1891.

No. 3194—Coal, at head of Right Fork of Middle Fork of Licking river, Magoffin county, Ky. Average from near the outcrop; some clay adhering. Collected by A. R. Crandall, October 25, 1891. The section is: Coal, 33 inches; bituminous shale, $11\frac{1}{2}$ inch; coal, 6 inches.

COMPOSITION OF THESE MAGOFFIN COUNTY COALS, AIR-DRIED.

Number	3190	3191	3192	3193	3194
Hygroscopic moisture	4.00	2.00	3.40	1.60	2.00
Volatile combustible matters	34.20	51.60	32.80	35.80	38.00
Coke	61.80	46.40	63.80	62.60	60.00
Totals	100.00	100.00	100.00	100.00	100.00
Total volatile matters	38.20	53.60	36.20	37.40	40.00
Fixed carbon in the coke	56.74	40.40	56.30	57.32	50.56
Ash	5.06	6.00	7.50	5.28	9.44
Totals	100.00	100.00	100.00	100.00	100.00
Percentage of sulphur	.862	.862	.862	.884	.384
Character of the coke	Spongy	Dense	Pulverulent	Spongy	Pulverulent
Color of the ash	White	Brownish grey	Very lt. grey	Very lt. grey	Very lt. grey

MARION COUNTY MINERAL WATER.

No. 3195—Mineral water, $1\frac{1}{2}$ mile southeast of Lebanon, Marion county, Ky., at base of a small knob, on land owned by Judge J. D. Beeden. Outflow, 15 to 20 gallons in 24 hours. Sample sent by Wm. M. Yowell, May, 1891.

COMPOSITION IN 1000 PARTS.

Carbonate lime.....	0.208
Carbonate magnesia.....	0.029
Chloride sodium.....	0.625
Chloride potassium.....	0.027
Sulphate of potassium.....	0.977
Sulphate of lime.....	0.480
Total solid matters.....	2.346

MARTIN COUNTY COALS.

No. 3196—Coal, from Scaffold Lick, Martin county, Ky. Average sample collected by A. R. Crandall, August 18, 1891. The section is: Coal, 14 inches; bone, $1\frac{1}{2}$ inches; coal, 29 inches; coal No. 2, (?).

No. 3197—Coal, from Beech Fork of Rockcastle creek, Martin county, Ky. First coal below the Peach Orchard seam. Average sample by A. R. Crandall, August 19, 1891, from the 36-inch bed. Entry driven to solid coal.

No. 3198—Coal, at head of Big Hollow, Middle Fork of Rockcastle creek, Martin county, Ky. Average sample from $51\frac{1}{2}$ -inch coal. Collected by A. R. Crandall, August 18, 1891.

No. 3199—Coal, from Beech Fork of Rockcastle creek, Martin county, Ky., the first coal above the Peach Orchard seam. Average sample from the 56-inch bed, by A. R. Crandall, August 19, 1891.

No. 3200—Coal, from Honey branch of Road Fork of Beech Fork of Rockcastle creek, Martin county, Ky. Bed next above the Peach Orchard coal. Average sample from the $63\frac{1}{2}$ -inch bed; no parting. Entry driven in 15 feet under roof. Collected by A. R. Crandall, August 19, 1891.

No. 3201—Coal, head of Scaffold Lick creek, Martin county, Ky. Average sample from 61½ inches, driven under roof. This is the coal next above the Peach Orchard seam. Collected by A. R. Crandall, August 18, 1891.

No. 3202—D. Long's coal, on Beech Fork of Rockcastle creek, Martin county, Ky. The bed is composed of three benches, 27 inches, 19 inches and 30 inches, respectively, with thin clay partings between them. Average sample of the whole bed; not a good sample. Collected by A. R. Crandall, 1891.

COMPOSITION OF THESE MARTIN COUNTY COALS, AIR-DRIED.

Number.....	3196	3197	3198	3199	3200	3201	3202
Hygroscopic moisture.....	2.86	3.52	3.08	3.78	5.20	3.40	2.42
Volatile combustible matters....	30.58	27.28	27.72	28.22	27.40	27.38	32.92
Coke.....	66.56	69.20	69.20	68.00	67.40	69.22	64.66
Totals.....	100.00	100.00	100.00	100.00	100.00	100.00	100.00
Total volatile matters.....	33.44	30.80	30.80	32.00	32.60	30.78	35.34
Fixed carbon in the coke.....	58.56	61.20	60.40	57.90	58.70	59.22	49.86
Ash.....	8.00	8.00	8.80	10.10	8.70	10.00	14.80
Totals.....	100.00	100.00	100.00	100.00	100.00	100.00	100.00
Percentage of sulphur.....	.549	.522	.43	.430	.308	.860	2.33
Character of the coke.....	Dense	Dense	Dense	Dense	Friable	Dense friable	Dense
Color of the ash....	Light brown- ish grey	Lt. grey	Very lt. grey	Very lt. grey	Grey	Grey	Light brown

MEADE COUNTY SHALE.

No. 3203—Green shale on side of Peter's Hill, Guston, Meade county, Ky.; Chester group, subcarboniferous. Collected by R. H. Loughridge.

A soft shale, of a greenish, dark gray color.

COMPOSITION, AIR-DRIED.

Sand and insoluble silicates.....	65.50
Alumina and peroxide of iron.....	14.00
Lime carbonate.....	5.52
Magnesia carbonate.....	1.06
Potash	2.51
Soda	1.08
Phosphoric acid.....	A trace
Water, etc., undetermined.....	10.33
Total.....	100.00

MEADE COUNTY LIMESTONES.

No. 3204—Dark grey oolitic limestone, from near Ekron, Meade county, Ky. Princeton group, or Upper St. Louis. Sample collected by R. H. Loughridge, March, 1891.

A light grey, fine granular limestone.

No. 3205—Limestone, on place of J. B. Withers, near Muldraugh's Hill, Meade county, Ky. Collected by R. H. Loughridge.

A compact limestone.

COMPOSITION OF THESE MEADE COUNTY LIMESTONES, AIR-DRIED.

Number	3204	3205
Carbonate lime.....	96.27	95.78
Carbonate magnesia.....	1.21	0.91
Alumina, peroxide of iron, etc.	2.40	2.00
Phosphoric acid	Trace	Trace
Silica	0.12	0.85
Totals	100.00	99.54

MEADE COUNTY SOILS.

No. 3206—Silt from the valley of the Ohio, at Concordia, Meade county, Ky. Collected by R. H. Loughridge, 1890.

The material was in friable lumps, of a light brownish-yellow color.

No. 3207—"Silty Loam" subsoil, on Chester Hills, near Paynesville, Meade county, Ky. Collected by R. H. Loughridge.

The material was in friable lumps, of a brownish-yellow color.

COMPOSITION OF THESE MEADE COUNTY SOILS, AIR-DRIED.

Number	3206	3207
Sand and insoluble silicates.....	85.92	93.14
Alumina and iron oxide.....	6.00	N. E.
Carbonate magnesia.....	1.21	5.03
Carbonate lime.....	Trace	Trace
Phosphoric acid.....	Trace	Trace
Moisture, etc., undetermined.....	6.87	1.83
Totals	100.00	100.00

The insoluble matter in these silts is mainly fine white sand.

MEADE COUNTY CLAY.

No. 3208—Clay, from the Ohio valley at the Louisville Salt Works, Meade county, Ky. Collected by R. H. Loughridge, May, 1891.

A light brownish-gray color; calcines to a very light reddish color, and is infusible before the blowpipe.

COMPOSITION, AIR-DRIED.

Silica	64.90
Alumina	20.80
Iron peroxide.....	1.60
Lime	1.06
Magnesia	0.94
Potash	1.93
Water, etc., undetermined.....	8.77
Total.....	100.00

MERCER COUNTY MINERAL WATER.

No. 3209—Sulphur water, from a well in the Spilman addition to North Harrodsburg, Mercer county, Ky. Sent by J. P. Spilman, M. D., June, 1890. The well is 72 feet deep, passing through 2 feet of clay then through the Hudson and into the Trenton. The water was struck at 70 feet, and there is an abundant supply, with also a good deal of combustible gas.

The water has a decided odor of hydrogen sulphide and a slight alkaline reaction.

COMPOSITION IN ONE LITER OF THE WATER.

(Specific gravity 1.0843.)

Hydrogen sulphide (free and combined).....	0.191 gram
Carbonic acid gas.....	N. E.
Carbonate of lime.....	0.038 gram
Carbonate of magnesia.....	0.046 gram
Chloride of calcium.....	0.115 gram
Chloride of magnesium.....	0.225 gram
Chloride of sodium.....	9.840 gram
Sulphate of lime.....	0.963 gram
Sulphate of magnesia.....	0.804 gram
Sulphate of potash.....	0.142 gram
Iodides and bromides.....	Marked traces
Sulphide of iron.....	Marked traces
Sulphide of sodium.....	N. E.
Silica	0.060 gram

Total saline matters.....12.233

This is a strong saline sulphur water, containing an abundance of hydrogen sulphide gas.

MORGAN COUNTY COALS.

No. 3210—Cannel coal, on Caney Fork of Licking river. Sample from the face of Drift 3, above the mouth of Prater Fork, Morgan county, Ky. Vein measures 44 inches, of which $22\frac{1}{2}$ inches is cannel. Collected by G. M. Sullivan, June 30, 1892.

No. 3211—Cannel coal, on Brushy Fork of Caney creek, Morgan county, Ky. (Isaac Lykins coal.) Vein is $42\frac{3}{4}$ inches

thick, of which 25 inches is cannel. Collected by G. M. Sullivan, June 30, 1892.

No. 3212—Cannel coal, on Sugar Camp branch of Brushy Fork of Caney creek, Morgan county, Ky. Vein is 45 inches thick, of which 25½ inches is cannel coal. Some pyrites present in the block from which the sample was taken. Collected by G. M. Sullivan, June 30, 1892.

No. 3213—Cannel coal, on Old House branch of Caney creek (Will Ferguson's land), Morgan county, Ky. Vein is 44½ inches thick, of which 24 inches is cannel coal. Sample from the 24-inch face, by G. M. Sullivan, June 30, 1892.

No. 3214—Cannel coal, from Drift No. 11 on Spring branch of Caney creek, Morgan county, Ky. Vein is 77 inches thick, of which 28½ inches is cannel. Sample from the face of the drift, collected by G. M. Sullivan, June 30, 1892.

No. 3215—Cannel coal, on Benton branch of Yearling branch of Brushy Fork of Caney creek, Morgan county, Ky. The upper cannel bed; the vein measures 28 inches, of which 22 inches is cannel. Collected by G. M. Sullivan, June 30, 1892.

COMPOSITION OF THESE MORGAN COUNTY COALS, AIR-DRIED.

Numbers	3210	3211	3212	3213	3214	3215
Hygroscopic moisture	1.60	1.36	1.30	1.20	1.80	1.20
Volatile combustible matters...	40.00	41.00	41.06	40.82	40.40	52.32
Coke	58.40	57.64	57.64	57.48	57.80	46.48
Totals	100.00	100.00	100.00	100.00	100.00	100.00
Total volatile matters	41.60	42.36	42.36	42.52	42.20	53.52
Fixed carbon in the coke	50.00	45.14	49.10	48.82	48.80	36.48
Ash	8.40	12.50	8.54	8.66	9.00	10.00
Totals	100.00	100.00	100.00	100.00	100.00	100.00
Percentage of sulphur	.549	.824	1.64	.824	2.71	0.728
Character of the coke	Dense	Dense	Dense	Dense	Dense	Pulverulent
Color of the ash	Lt. grey	Light brown	Light brownish grey	White	Brownish grey	Brownish grey

No. 3216—Cannel coal, from face of opening on Johnson's branch of Prater Fork of Caney creek, on north side of the branch, Morgan county, Ky. Bed $43\frac{1}{2}$ inches thick, of which 21 inches is cannel coal. Collected by G. M. Sullivan, July 7, 1892.

No. 3217—Coal, from Drift No. 1, Sugar Camp branch of Brushy Fork of Caney creek, Morgan county, Ky. Collected by G. M. Sullivan, July 6, 1892.

No. 3218—Cannel coal, cuttings from Hole 10, on Caney creek, Morgan county, Ky. Collected by G. M. Sullivan.

COMPOSITION OF THESE MORGAN COUNTY COALS, AIR-DRIED.

Number	3216	3217	3218
Hygroscopic moisture	2.20	2.10	2.40
Volatile combustible matters	40.60	40.70	37.92
Coke	57.20	57.20	59.68
Totals	100.00	100.00	100.00
Total volatile matters	42.80	42.80	40.32
Fixed carbon in the coke	50.20	51.20	49.68
Ash	7.00	6.00	10.00
Totals	100.00	100.00	100.00
Percentage of sulphur	1.20	0.74	1.098
Character of the coke	Dense	Dense	Dense
Color of the ash	Light grey	Brownish gr.	White

McCracken County Clay.

No. 3219—Clay, from a well sunk 16 feet into the bed of clay, on land formerly owned by J. M. Carter, McCracken county, Ky. Average sample, obtained by taking portions about every 6 inches; sent by L. W. Robertson, the present owner, June, 1896. Mr. Robertson has bored 22 feet into the bed without passing through it.

A nearly white clay, some parts grayish and some pinkish

from infiltrated iron; it is very plastic. Before the blowpipe the clay is quite refractory, fusing only on thin edges; it burns white or pinkish.

COMPOSITION, DRIED AT 100° C.

Silica	54.74
Alumina	30.53
Peroxide of iron.....	1.67
Lime	0.18
Magnesia	0.48
Potash	1.54
Soda and lithia.....	0.25
Water, etc., by ignition.....	10.61
Total	100.00

NELSON COUNTY MINERAL WATER.

No. 3220—Mineral water, from a spring, Nelson county, Ky. Sample sent by Alex. P. Samuels, Samuels, Ky., October, 1895, from a spring recently found by W. B. Samuels, near that place.

The water was colorless, with very little taste and no smell. There was a slight brownish sediment in the jug.

A qualitative analysis gave the following results:

Carbonate of iron in moderate amount.	} Held in solution by carbonic acid.
Carbonate of lime in considerable amount.	
Carbonate of magnesia in moderate amount.	
Sulphate of lime, small amount.	
Sulphate of magnesia, small amount.	
Chloride of sodium, small amount.	
Chloride of potassium, traces.	
Nitrates, traces.	
Organic matters, marked traces.	
Total solid matters, 33.6 grains per gallon, or 0.576 parts in 1000.	
Free ammonia, 0.8 part in 1,000,000.	
Albuminoid ammonia, 1.4 part in 1,000,000.	

The free and albuminoid ammonia in this water are suspiciously high, which suggests contamination with some kind of drainage, and it should not be used for drinking without carefully considering such a possibility. If its source is undoubtedly free from such contamination, the water may be of some value as a mild chalybeate.

NICHOLAS COUNTY MINERAL WATER.

No. 3221—Mineral water, from well 145 feet deep, at Deering Camp Grounds (Parks Hill), Nicholas county, Ky. Sent by R. M. Parks, Carlisle, Ky., June, 1893. The well had been pumped for two hours preparatory to drawing this sample.

The water was sent in a sealed glass bottle, but contained so much gas as to force out the cork. It smelled only slightly of hydrogen sulphide.

ANALYSIS.		Grams per liter.	Grains per gal.
Gases.....	{ Carbonic acid gas.....	0.26	15.18
	{ Hydrogen sulphide	a small quantity	
Held in solution by carbonic acid.	{ Carbonate of lime	.1004	5.86
	{ Carbonate of magnesia	.0141	.82
	{ Carbonate of iron.....	traces	
Saline matter	{ Chloride of magnesium.....	.1038	6.06
	{ Chloride of sodium	3.6046	210.51
	{ Carbonate of soda	.3229	18.86
	{ Iodides, bromides and borates.....	notable quantities	
	{ Strontium, lithium, potassium, silica and sulphates	traces	
	{ Total solid matters.....	4.1458	242.11

OHIO COUNTY COALS.

No. 3222—Coal, from the face of the “Dean Field” coal mine, on the line of the Owensboro & Falls Rough R. R., in Ohio county, Ky., 20 miles southeast from Owensboro, near Deserter’s Fork, a tributary of South Panther’s creek. The coal is 4 feet 6 inches thick. The rock over the coal is grit sandstone, 20 feet thick; coal rests on fire-clay 4 inches thick. Sample sent by R. S. Triplett, November, 1890.

No. 3223—Coal (No. 3 of the Geological Survey), labeled “From Worrall Mountain, 22 miles southeast of Owensboro, on the line of O. F. of R. & G. R. R., Ohio county, Ky. Sample from 30 yards; bed 3 feet 6 inches, increasing 1 inch per yard.” Sent by R. S. Triplett, January, 1892.

No. 3224—Coal (No. 4 of the Geological Survey), labeled “Block coal from Worrall Mountain, 22 miles southeast of Owensboro, on the line of the O. F. of R. & G. R. R., Ohio county, Ky.” Sample sent by R. S. Triplett, January, 1892.

COMPOSITION OF THESE OHIO COUNTY COALS, AIR-DRIED.

Number	3222	3223	3224
Hygroscopic moisture	4.78	2.00	2.00
Volatile combustible matters	35.22	42.34	34.14
Coke	60.00	55.66	63.86
Totals	100.00	100.00	100.00
Total volatile matters	40.00	44.34	36.14
Fixed carbon in the coke	49.40	51.66	61.26
Ash	10.60	4.00	2.60
Totals	100.00	100.00	100.00
Percentage of sulphur	1.39	1.51	0.82
Character of the coke	Spongy	Spongy	Spongy
Color of the ash	Light grey	Light grey brown	Light grey brown

OHIO COUNTY MINERAL WATERS.

No. 3225—Mineral water, from a well of D. M. Wells, of Deanfield, Ohio county, Ky. Sent by R. S. Triplett, July, 1891.

COMPOSITION IN 1000 PARTS OF THE WATER.

Sulphate of iron	0.779
Sulphate of lime	0.107
Sulphate of magnesia	0.159
Sulphate of potash	0.045
Sulphate of soda	0.070
Free sulphuric acid	0.015
Silica	0.055
Total saline matters	1.230

This is an acid chalybeate water.

No. 3226—Saline residue obtained by boiling a gallon of water from a mineral spring on Worrall Mountain, Ohio county, Ky. Sent by R. S. Triplett, January, 1892.

The dried residue weighed 7.55 grammes, equivalent to about 2 parts in 1,000 of the water, or about 116 grains to the gallon.

The residue contained much iron and lime in the form of sulphates, a little magnesia and a little sodium chloride.

This is probably a chalybeate water similar to No. 3225, and deserves further analysis.

PIKE COUNTY COALS.

No. 3227—Coal, from Big creek, Pike county, Ky. Average sample from 48-inch bed, without parting. Collected by A. R. Crandall, September 10, 1890.

No. 3228—Coal, from Sycamore Fork of Marrowbone creek, Pike county, Ky. Average sample from 47-inch bed; no parting. Collected by A. R. Crandall, September 7, 1890.

No. 3229—Coal, on Ferrell's creek, Pike county, Ky. Average sample from 6-foot face; no parting; not driven under roof. Collected by A. R. Crandall, September 8, 1890.

No. 3230—Coal, on Marrowbone creek, Pike county, Ky. Average sample from the lower part (see No. 3232). Collected by A. R. Crandall, September 7, 1890. The section is: Coal, 33 inches; shale, 6 inches; coal, 7 inches. Driven under roof.

No. 3231—Coal, on Big creek of Levisa Fork, Pike county, Ky. Average sample from 74-inch face; no parting. Collected by A. R. Crandall, September 10, 1890.

No. 3232—Coal, Marrowbone creek, Pike county, Ky. Geological position, fourth coal. Average sample of 50-inch face at outcrop, upper bench, some clay adhering. Collected by A. R. Crandall, September 7, 1890.

COMPOSITION OF THESE PIKE COUNTY COALS, AIR-DRIED.

Number	3227	3228	3229	3230	3231	3232
Hygroscopic moisture	1.06	1.76	7.54	1.40	2.00	9.10
Volatile combustible matters	28.78	27.34	25.14	34.06	26.80	25.58
Coke	70.16	70.90	67.32	64.54	71.20	65.32
Totals	100.00	100.00	100.00	100.00	100.00	100.00
Total volatile matters	29.84	29.10	32.68	35.46	28.80	34.68
Fixed carbon in the coke	63.96	59.46	60.62	61.70	63.20	58.62
Ash	6.20	11.44	6.70	2.84	8.00	6.70
Totals	100.00	100.00	100.00	100.00	100.00	100.00
Percentage of sulphur	.626	.382	.428	.732	.431	.329
Character of the coke	Spongy	Spongy	Pulverulent	Light spongy	Spongy	Pulverulent
Color of the ash	Light grey	Grey	Brownishgrey	Brownishgrey	Grey	Light brownishgrey

No. 3233—Coal, from Levisa Fork of Big Sandy river, Pike county, Ky. Average sample from 86-inch face, including 1½ inches of slate 9 inches from the bottom. Collected by A. R. Crandall, September 9, 1890.

No. 3234—Coal, from Card creek near its mouth, Pike county, Ky. Average sample from upper bench, 41½ inches. (The parting is 6 to 8 inches and the lower bench 8 to 10 inches.) Collected by A. R. Crandall, September 9, 1890.

No. 3235—Coal, head of Sloan's Fork of Coon creek, Pike county, Ky. Geological position, Elkhorn coal. Average sample from the 48-inch face. There is ½ inch of clay 1 foot from the top. Collected by A. R. Crandall, September 11, 1890.

No. 3236—Coal, on Sycamore branch of Marrowbone creek, Pike county, Ky. Average sample of the 44-inch face, driven under the roof. (Powdery in part.) Collected by A. R. Crandall, September 7, 1890.

No. 3237—Coal, on Terrell's creek, Pike county, Ky. Average sample from 63½-inch face; no parting. Not driven under roof. Collected by A. R. Crandall, September 8, 1890.

No. 3238—Coal, Lower Pompey, Pike county, Ky.; John Robinson's bank. Average sample from 48-inch face, which has a 1-inch slate parting 2 inches from the bottom. Collected by A. R. Crandall.

COMPOSITION OF THESE PIKE COUNTY COALS, AIR-DRIED.

Number	3233	3234	3235	3236	3237	3238
Hygroscopic moisture	5.14	1.14	1.32	1.32	7.76	1.20
Volatile combustible matters	23.96	26.96	31.68	29.98	23.30	32.20
Coke	70.90	71.90	67.00	68.70	68.94	66.60
Totals	100.00	100.00	100.00	100.00	100.00	100.00
Total volatile matters	29.10	28.10	33.00	31.30	31.06	33.40
Fixed carbon in the coke	61.90	64.58	61.60	62.90	61.46	54.38
Ash	9.00	7.32	5.40	5.80	7.48	12.22
Totals	100.00	100.00	100.00	100.00	100.00	100.00
Percentage of sulphur	.302	1.854	.949	.357	.567	1.511
Character of the coke	Pulverulent	Spongy	Light spongy	Light spongy	Pulverulent	Spongy
Color of the ash	Grey	Dark grey	Light grey	White	Brownish grey	Grey

No. 3239—Coal, on Little Card creek, near the head, Pike county, Ky. Geological position, Elkhorn coal. Bed 74 inches thick. Average sample collected by A. R. Crandall, September 8, 1890.

No. 3240—Coal, Trace branch of the Right Fork of Grape Vine creek, Pike county, Ky. Average sample from the 32-inch face, without parting. Splint coal 2 inches midway. Collected by A. R. Crandall, September 11, 1890.

No. 3241—Coal, Flat Woods, head of Sycamore creek, a tributary of Elkhorn creek, Pike county, Ky. Average sample of the 48-inch bed, at the outcrop, 1,400 feet above Elkhorn creek, collected by J. T. Profit, 1890.

COMPOSITION OF THESE PIKE COUNTY COALS, AIR-DRIED.

Number	3239	3240	3241
Hygroscopic moisture	5.64	1.50	2.00
Volatile combustible matters.....	23.30	29.66	33.70
Coke	71.06	68.84	64.30
Totals	100.00	100.00	100.00
Total volatile matters	28.94	31.16	35.70
Fixed carbon in the coke	64.26	60.34	58.70
Ash	6.80	8.50	5.60
Totals	100.00	100.00	100.00
Percentage of sulphur.....	.549	.813	.521
Character of the coke.....	Pulverulent	Spongy	Spongy
Color of the ash.....	Brownish grey	Brownish grey	Light grey brown

ROCKCASTLE COUNTY LIMESTONES.

No. 3242—Limestone, labeled "From a quarry on Copper creek and Dix river, in Rockcastle county, Ky., about 4 miles from Crab Orchard, on the east side of the L. & N. Railroad, and about 1 mile from it, and about 12 miles northwest of Mount Vernon. Bed 9 feet thick." Sent by J. H. Sowder, August, 1891.

A dense rock of a light grey color, said to take a good polish.

No. 3243—Limestone, labeled "Building stone," from the same quarry as No. 3242. Sent by J. H. Sowder, September, 1891.

Quite a hard, compact, light grey stone, containing a few small fossil shells and some small crystals. Mr. Sowder states that this stone withstands frost perfectly and takes a beautiful polish.

COMPOSITION OF THESE ROCKCASTLE COUNTY LIMESTONES,
AIR-DRIED.

Number	3242	3243
Carbonate of lime.....	92.00	68.00
Carbonate of magnesia.....	0.75	18.16
Peroxide of iron, alumina, etc.	1.36	5.60
Silica	1.36	4.00
Moisture and undetermined, etc.	4.53	4.24
Totals	100.00	100.00
Percentage of lime.....	51.5	38.1

ROCKCASTLE COUNTY CLAYS.

No. 3244—Fire-clay, from the bottom of the bed, 6 to 9 feet thick, on the land of E. W. Hansel, 3 miles southeast of Mt. Vernon, Rockcastle county, Ky. This particular character of clay is 4½ to 7 feet thick. Sample collected by A. G. Lowell, April, 1892.

A dark grey clay, refractory before the blowpipe; calcines white.

COMPOSITION, AIR-DRIED.

Silica	68.00
Alumina	21.40
Lime and magnesia.....	Traces
Potash and soda.....	0.60
Moisture, combined water, etc.	10.00
Total	100.00

No. 3245—Fire-clay, from the top of the bed, 6 to 9 feet, on the land of E. W. Hansel, 3 miles southeast of Mt. Vernon, Rockcastle county, Ky. This particular character of clay is 14 inches to 20 inches thick, the line of demarkation being very distinct. Sample by A. G. Lowell, April, 1892. (See No. 3244.)

COMPOSITION, AIR-DRIED.

Silica	52.44
Alumina	40.80
Carbonate magnesia.....	Trace
Potash	Traces
Moisture, etc.	6.76
Total.....	<u>100.00</u>

These two clays would make good fire-brick and would answer for some kinds of pottery.

ROWAN COUNTY IRON ORE.

No. 3246—Iron ore, bed 4 feet thick (60 feet wide exposed), on the branch of Crany creek, about 4 miles from its mouth, in the southeast part of Rowan county, Ky. Sample sent by A. J. Thurber, September, 1891.

A tough, compact, dark grey carbonate of iron.

COMPOSITION, AIR-DRIED.

Carbonate of iron.....	64.48
Carbonate of lime.....	4.00
Carbonate of magnesia.....	1.50
Alumina	5.63
Silica	19.00
Phosphoric acid.....	Trace
Moisture and loss.....	5.39
Total	<u>100.00</u>
Percentage of iron.....	31.13

With this sample Mr. Thurber sent a piece from the bottom of the same bed. This proved to be the same ore, but somewhat oxidized, and containing bright crystals of zinc sulphide (blende).

TRIGG COUNTY LEAD ORE.

No. 3247—Galena, sent by Samuel Rayburn, Trigg Furnace, Trigg county, Ky., November, 1891.

Analysis in the wet way gave 66.3 per cent. of lead, equivalent to 97 per cent. of sulphide of lead, showing the sample to be quite pure galena.

WARREN COUNTY WATERS.

No. 3248—Water, from a well on the farm of Messrs. Porter and Cooke, about 2 miles from Bowling Green, Warren county, Ky. The well is 200 feet deep and about 300 yards from Barren river, on a high rise. Sample sent by J. B. Cooke, August 30, 1890.

The water is said to deposit a slight grey sediment at the well.

No. 3249—Mineral water; a noted spring, called "Allen Spring," situated in Warren county, Ky., directly on the road from Bowling Green to Scottsville, and 12 miles from Bowling Green. The flow is about an inch stream. Sample sent by W. H. Blakeley, November 19, 1891.

No. 3250—Chalybeate water, from a well 117 feet deep, $6\frac{1}{2}$ miles south of Bowling Green, Warren county, Ky. This well was bored by Chas. C. Smith, and is about $1\frac{1}{2}$ miles from the Mercer's well, the water of which was analyzed about a year ago. Sample sent by Jno. E. Younglove, January, 1891.

No. 3251—Mineral water, from a well 170 feet deep, on the farm of J. D. Loving, 2 miles southwest of Bowling Green, Warren county, Ky., on the Louisville and Nashville turnpike. It is stated that water of this character and carrying a little hydrogen sulphide is almost invariably found by boring at a depth of 150 to 200 feet in this section. Sample sent by J. E. Younglove, July, 1891.

COMPOSITION OF THESE WARREN COUNTY WATERS IN 1000 PARTS.

Number	3048	3049	3050	3051	
Iron carbonate.....	.....	.....	0.0883	.....	} Held in solution by carbonic acid.
Lime carbonate.....	0.1640	0.120	0.2000	0.178	
Magnesia carbonate.....	0.0290	0.009	0.0240	0.020	
Sodium chloride.....	0.0222	0.100	0.0522	0.103	
Potassium chloride.....	0.0098	.....	0.0014	.....	
Lime sulphate.....	.....	1.469	0.0260	0.143	
Magnesia sulphate.....	.....	0.129	0.0051	0.004	
Soda sulphate.....	.....	0.110	.....	0.294	
Potash sulphate.....	.....	.....	.....	0.030	
Iron sulphate.....	.....	.....	.....	Trace	
Silica, clay, etc.....	0.0080	0.300	0.0500	0.103	
Total saline matters...	0.2330	2.237	0.3587	0.772	

No. 3248 is a hard limestone water, not properly to be called a mineral water; No. 3249 is a calcic water, No. 3250 a saline chalybeate, and No. 3251 a saline, only very slightly chalybeate.

WARREN COUNTY SOILS.

No. 3252—Virgin soil, from the Chester sandstone, about 3 miles north of Bowling Green, Warren county, Ky., from the top of a ridge 250 feet above Barren river and immediately upon the lowest bed of Chester sandstone, which is about 50 feet thick. Sample sent by M. H. Crump, November 25, 1890.

A light buff-grey soil. All passed through the coarse sieve except a few very small particles of iron ore and vegetable debris.

No. 3253—Soil, from the same locality as the next preceding, in Warren county, Ky., but has been cleared 60 or 75 years and moderately cultivated. Sample sent by M. H. Crump along with No. 3252.

All passed through the coarse sieve except a very small residue of fine fragments of iron ore and fine sand.

COMPOSITION OF THESE WARREN COUNTY SOILS, AIR-DRIED.

Number	3252	3253
Hygroscopic moisture.....	1.500	1.500
Organic and volatile matters.....	3.000	2.450
Alumina, iron oxide, etc.	4.857	4.200
Carbonate of lime.....	0.710	3.000
Carbonate of magnesia.....	0.517	1.900
Phosphoric acid	0.314	0.259
Potash	0.267	0.270
Soda	0.529	0.280
Sand and insoluble silicates.....	88.055	85.905
Total	99.749	99.764
Character of the soil.....	Virgin	Old field

WAYNE COUNTY MINERAL WATER.

No. 3254—Mineral water, from a spring on the land of F. D. Shearer, situated "on the waters of Otter creek, Wayne county, Ky." Flow about 2 gallons per hour. Sample sent by Hon. J. H. Shearer, Gap Creek, Ky., March, 1890, who designates it as a "white sulphur water."

When received at the laboratory the water contained no hydrogen sulphide, although the bottle had been tightly corked. There was a very light, white sediment in the bottle, which was found to consist of carbonate of lime and carbonate of magnesia. The water has a slight smell of petroleum.

COMPOSITION IN 1000 PARTS OF THE WATER.

Lime carbonate.....	0.1128	} Held in solution by carbonic acid.
Magnesia carbonate.....	0.0100	
Sodium chloride.....	0.1660	
Potassium chloride.....	0.1140	
Calcium chloride.....	0.1437	
Lime sulphate.....	0.0770	
Magnesia sulphate.....	0.0385	
Alumina sulphate.....	0.0562	
Silica	0.0050	
Total saline matters.....	0.7232	

This is a weak astringent saline water. The analysis does not show it to be sulphur water, but it is possible that it may originally have contained a small amount of hydrogen sulphide, which may have escaped before the sample reached the laboratory.

WAYNE COUNTY COAL.

No. 3255—Coal, from spur of Poplar Mountain, on East Fork of Carpenters' Fork of Otter creek, Wayne county, Ky. Sub-conglomerate. Sample by John R. Procter, November 26, 1891.

COMPOSITION, AIR-DRIED.

Hygroscopic moisture.....	0.52
Volatile combustible matters.....	37.68
Coke	61.80
Total.....	100.00
Total volatile matters.....	38.20
Fixed carbon in the coke.....	52.96
Ash	8.84
Total.....	100.00
Percentage of sulphur.....	1.92
Character of the coke.....	Spongy
Color of the ash.....	Light grey

WHITLEY COUNTY COAL.

No. 3256—Coal, from Jones branch of Beck's creek, Whitley county, Ky. "Jellico coal." Sample from the whole face of the bed. There are 39 inches of coal above the parting, then a 6-inch parting, and 10½ inches of coal below the parting. Collected by A. R. Crandall, November 26, 1890.

COMPOSITION, AIR-DRIED.

Hygroscopic moisture.....	1.76
Volatile combustible matters.....	37.86
Coke	60.38
Total.....	100.00
Total volatile matters.....	39.62
Fixed carbon in the coke.....	53.98
Ash	6.40
Total.....	100.00
Percentage of sulphur.....	0.607
Character of the coke.....	Light, spongy
Color of the ash.....	Brown-grey

WOODFORD COUNTY MINERAL WATER.

No. 3257—Mineral water, from Versailles, Woodford county, Ky. Sent by George Craig.

COMPOSITION.

Sulphuretted hydrogen and carbonic acid gases in moderate amount.
Bicarbonates of lime and magnesia in moderate amounts.
Bicarbonate of lithium, a trace (quite marked).
Sulphate of magnesium, in small quantity.
Sulphate of potassium in small quantity.
Iodides, bromides and borates, marked traces.
Organic matter and ammonia salts, traces.
Total saline matters, 129.3 grains per gallon, equivalent to 2.217 parts in 1000.

This water belongs to the class of alkaline-saline sulphur waters, and should have some medicinal value. Its composition indicates that it would probably be efficacious in skin diseases, chronic rheumatism, etc.

TENNESSEE COALS.

No. 3258—Coal, from Rea county, Tenn., from the mines of Anglo-American Association (Limited), Spring City, Tenn. A remarkably pure looking, bright coal, breaking imperfectly in laminae; some curved, with shining surfaces; no appearance of pyrites or fibrous coal. Resembles the "Albert coal," of Nova Scotia.

No. 3259—Coal, on Burley's Fork of Bennett's Fork of Yellow creek, Claiborne county, Tenn. Bed 28 to 31 inches, with 4 to 6 partings. Collected by A. R. Crandall, August 18, 1890.

No. 3260—Coal, on New Cabin branch of Bennett's Fork of Yellow creek, Claiborne county, Tenn. Sample from 52-inch bench, by G. M. Sullivan, September 29, 1891.

No. 3261—Coal, on New Cabin branch of Bennett's Fork of Yellow creek, Claiborne county, Tenn. Sample from the 43-inch face, with 1/2-inch slate 9 inches from the top. Collected by G. M. Sullivan, September 29, 1891.

No. 3262—Coal, at head of Bennett's Fork of Yellow creek, Claiborne county, Tenn. Sample from the C. W. Livermore opening in the bed, and represents 49 inches of coal. The section is: Coal, $29\frac{1}{2}$ inches; clay, 10 inches; coal, $19\frac{1}{2}$ inches. Collected by G. M. Sullivan, September 29, 1891.

No. 3263—Coal, on Bennett's Fork of Yellow creek, Claiborne county, Tenn. Sample from 42-inch bench, which has a parting of sandstone 8 inches from the top. Collected by G. M. Sullivan, September 7, 1891.

COMPOSITION OF THESE TENNESSEE COALS, AIR-DRIED.

Number	3258	3259	3260	3261	3262	3263
Hygroscopic moisture	1.20	1.80	2.20	2.80	0.12	0.76
Volatile combustible matters...	33.46	32.50	35.20	30.48	37.88	32.82
Coke	65.34	65.70	62.60	66.72	62.00	66.42
Totals	100.00	100.00	100.00	100.00	100.00	100.00
Total volatile matters	34.66	34.30	37.40	33.28	38.00	33.58
Fixed carbon in the coke	54.74	58.76	59.00	56.98	58.00	56.42
Ash	10.60	6.94	3.60	9.74	4.00	10.00
Totals	100.00	100.00	100.00	100.00	100.00	100.00
Percentage of sulphur.....	.728	1.096	.673	.989	.824	.576
Character of the coke.....	Much inflated	Light spongy	Spongy	Dense	Spongy	Spongy
Color of the ash	Nearly white	Grey brown	Light brownish grey	Very light grey	Light brownish grey	Grey

No. 3264—Coal, on New Cabin branch of Bennett's Fork of Yellow creek, Claiborne county, Tenn. Sample from a 41-inch outcrop, which has a $\frac{1}{2}$ -inch sandstone parting 6 inches from the top. Collected by G. M. Sullivan, September 29, 1891.

No. 3265—Coal, on Bennett's Fork of Yellow creek, Claiborne county, Tenn. Sample taken from the 53-inch face. The partings were rejected. The section is: Coal, 17 inches; clay, $\frac{1}{2}$ inch; coal, 2 inches; clay, $\frac{3}{4}$ inch; coal, $21\frac{1}{4}$ inches; clay, $41\frac{1}{2}$ inches; coal, $26\frac{3}{4}$ inches. Collected by G. M. Sullivan, September 7, 1891.

No. 3266—Coal, on New Cabin branch of Bennett's Fork of Yellow creek, Claiborne county, Tenn. Sample from a 39-inch bench, which has 1 inch of bone coal 14 inches from the top. Collected by G. M. Sullivan, September 29, 1891.

No. 3267—Coal, at head of New Cabin branch, on Bryson Mountain, Claiborne county, Tenn. Sample from a 39-inch outcrop. Collected by G. M. Sullivan, September 29, 1891.

No. 3268—Coal, on Pigeon Roost branch of Hurricane Fork of Valley creek, Claiborne county, Tenn. Good average sample from the clean face, collected by G. M. Sullivan, October 25, 1892. (See note-book 31, p. 34.)

No. 3269—Coal, on Pigeon Roost branch of Hurricane Fork of Valley creek, Claiborne county, Tenn. New outcrop, free from clay. Collected by G. M. Sullivan, October 25, 1892. (See note-book 31, p. 34.)

No. 3270—Coal, on Grave branch of Hurricane Fork of Valley creek, Claiborne county, Tenn. Collected by A. R. Crandall, October 24, 1892. (See note-book 31, p. 32.)

No. 3271—Coal, on Grave branch of Hurricane Fork of Valley creek, Claiborne county, Tenn. Geological position, 57-inch coal (Bryson's Mountain coal). Collected by A. R. Crandall, October 24, 1892. (See note-book 31, p. 32.) Some clay adhering.

COMPOSITION OF THESE TENNESSEE COALS, AIR-DRIED.

Number.....	3264	3265	3266	3267	3268	3269	3270	3271
Hygroscopic moisture.....	2.00	2.10	0.96	3.40	0.92	0.91	3.11	2.28
Vol. combustible matter ...	33.00	35.50	31.14	33.40	35.55	34.24	32.65	34.21
Coke.....	65.00	62.40	67.90	63.20	63.53	64.85	64.24	63.51
Totals.....	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00
Total volatile matters.....	35.00	37.60	32.10	36.80	36.47	35.15	35.76	36.49
Fixed carbon in the coke...	57.80	56.68	55.90	55.20	60.09	58.07	59.83	55.56
Ash.....	7.20	5.72	12.00	8.00	3.44	6.78	4.41	7.95
Totals.....	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00
Percentage of sulphur.....	.551	.728	.603	.741	0.94	0.89	0.76	0.75
Character of the coke.....	Dense	Light spongy	Dense	Dense	Light spongy	Light spongy	Pulver- ulent	Dense
Color of the ash.....	Brown- ishgrey	Light grey	Grey	grey	Light salmon	Very pale salmon	Brown- ish yellow	Creamy white

TENNESSEE COKES.

No. 3272—Coke, from the Glen Mary Coal and Coke Co., Glen Mary, Tenn. Made from ground slack. Sample consisted of a single piece of about 2 pounds. Sent by A. I. Totten, manager, November, 1893.

No. 3273—Coke, from the Glen Mary Coal and Coke Co., Glen Mary, Tenn. Made from run of mine, disintegrated. The sample consisted of a column of fine looking bright coke, representing the whole thickness of the charge. Sent by A. I. Totten, manager, March, 1895.

COMPOSITION OF THESE TENNESSEE COKES, AIR-DRIED.

Number	3272	3273
Hygroscopic moisture	0.22	0.16
Volatile combustible matters		0.08
Coke	99.78	99.76
Totals	100.00	100.00
Total volatile matters	.22	.24
Fixed carbon	88.30	88.34
Ashes	11.48	11.42
Totals	100.00	100.00
Color of ash	Reddish brown	Light brown
Sulphur	.122	.118



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